COLORADO DEPARTMENT OF PUBLIC HEALTH
AND ENVIRONMENT

HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION

SITE INSPECTION
~~DRAFT~~ PGS

COMPREHENSIVE ANALYTICAL RESULTS REPORT

CEMENT CREEK WATERSHED (CERCLIS ID # CO0001411347)

SAN JUAN COUNTY, COLORADO

Prepared by:
Camille Farrell
April, 1998

Approved: ______________________________ Date: ______
Rick Brown, Program Manager, CDPHE

Approved: P G Smith Date: 7/22/99
Pat G. Smith, Site Assessment Manager, EPA

COLORADO DEPARTMENT OF PUBLIC HEALTH
AND ENVIRONMENT

HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION

SITE INSPECTION PGS
~~DRAFT~~

COMPREHENSIVE ANALYTICAL RESULTS REPORT

CEMENT CREEK WATERSHED (CERCLIS ID # CO0001411347)

SAN JUAN COUNTY, COLORADO

Prepared by:
Camille Farrell
April, 1998

Approved: ______________________ **Date:** ______
Rick Brown, Program Manager, CDPHE

Approved: PGSmith **Date:** 7/22/99
Pat G. Smith, Site Assessment Manager, EPA

STATE OF COLORADO

Roy Romer, Governor
Patti Shwayder, Acting Executive Director

Dedicated to protecting and improving the health and environment of the people of Colorado

Main Building
4300 Cherry Creek Dr. S.
Denver, Colorado 80222-1530
Phone (303) 692-2000

Laboratory Building
4210 E. 11th Avenue
Denver, Colorado 80220-3716
(303) 691-4700

Colorado Department
of Public Health
and Environment

TO: Pat Smith *Pat*

FROM: Camille Farrell *Camille*

DATE: April 13, 1998

RE: DRAFT Cement Creek Analytical Results Report

Enclosed, please find the DRAFT Cement Creek Analytical Results Report (ARR) for your review and comment.

I can be reached at (970) 728-5487 or at
P.O. Box 2927
Telluride, Colorado 81435.

cc: Dan Scheppers

COLORADO DEPARTMENT OF PUBLIC HEALTH
AND ENVIRONMENT

HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION

SITE INSPECTION

DRAFT

<u>COMPREHENSIVE ANALYTICAL RESULTS REPORT</u>

CEMENT CREEK WATERSHED (CERCLIS ID # CO0001411347)

SAN JUAN COUNTY, COLORADO

Prepared by:
Camille Farrell
April, 1998

Approved: ______________________________ **Date:** ______
Rick Brown, Program Manager, CDPHE

Approved: ______________________________ **Date:** ______
Pat G. Smith, Site Assessment Manager, EPA

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

TABLE OF CONTENTS

COLORADO DEPARTMENT OF PUBLIC HEALTH
AND ENVIRONMENT

HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION

SITE INSPECTION

DRAFT

ANALYTICAL RESULTS REPORT

CEMENT CREEK WATERSHED (CERCLIS ID # CO0001411347)

SAN JUAN COUNTY, COLORADO

Prepared by:
Camille Farrell
April, 1998

Approved: ______________________________ **Date:** ________
Rick Brown, Program Manager, CDPHE

Approved: ______________________________ **Date:** ________
Pat G. Smith, Site Assessment Manager, EPA

SITE INSPECTION
COMPREHENSIVE ANALYTICAL RESULTS REPORT
CEMENT CREEK WATERSHED (CERCLIS ID # CO 0001411347)
SAN JUAN COUNTY, COLORADO

1.0 INTRODUCTION

Under a Cooperative Agreement with the United States Environmental Protection Agency (EPA), the Hazardous Materials and Waste Management Division of the Colorado Department of Public Health and Environment (CDPHE) conducted a Site Inspection (SI) of Upper Cement Creek and Prospect Gulch, known collectively as the Cement Creek Watershed, located near Silverton, San Juan County, Colorado. The study was designed to evaluate the impact of mining in the Silverton Mining District. The work was performed under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA or "Superfund"), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), for the EPA Region VIII Superfund Remedial Screening Program. The SI was designed to bridge with sampling efforts of the Colorado Division of Minerals and Geology's (DMG) Non Point Source *Animas River Targeting Continuation Project*, as possible under the Site Assessment Program.

This Comprehensive Analytical Results Report (ARR) presents the results of the sampling program which was conducted from August 6 through October 2, 1996. For background information the reader is referred to the *Animas Discovery Report* (CDPHE, 1995), the Cement Creek Sampling and Analysis Plan (SAP) (CDPHE, 1996a), and the Cement Creek Sampling Activities Report (SAR) (CDPHE, 1996b). The SAR is included as Appendix A.

The sampling conducted by CDPHE complimented the DMG sampling efforts: where DMG collected surface water samples, CDPHE collected collocated sediment samples (of which 10% were analyzed for cyanide and organic compounds); CDPHE analyzed 10% of DMG's surface water samples for cyanide and organic compounds. Where DMG collected aqueous samples, CDPHE collected solid source samples; additionally, CDPHE collected solid source samples where aqueous source samples were not collected by DMG. CDPHE also collected residential drinking water from both groundwater wells and surface water sources at 5 locations.

Site reconnaissance and sampling of mine waste rock source characterization samples were conducted between August 6 and 8, 1996. Ground water sampling activities were carried out on September 16 and 17, 1996. Aqueous and sediment sampling activities occurred on September 30, October 1 and 2, 1996. The sampling was performed in accordance with the Cement Creek Watershed Sample and Analysis Plan (CDPHE, 1996), approved by EPA on July 26, 1996, except as noted in Section 3.0 of the Cement Creek Sample Activities Report.

The CDPHE sampling activities in Cement Creek included the collection of 79 samples. A total of 5 ground water, 6 surface water, 53 sediments, and 15 solid source characterization samples were collected. The 5 ground water samples were analyzed for total and dissolved metals. Six aqueous samples (10 % of DMG surface water) were analyzed for Pesticides/Polychlorinated Biphenyls (PCBs), Base/Neutral/Acid Extractable Organics (BNAs), and Volatile Organics (VOA), Cyanide and Total Organic Carbon (TOC). Six sediment samples collocated with the aqueous samples (10% of CDPHE sediment samples) were also be analyzed for PCBs, BNAs, VOA, Cyanide and total metals. The remaining 47 sediment samples, collocated with DMG's aqueous samples, were analyzed for total metals. Fifteen (15) mine dump source characterization samples were also analyzed for total metals analyses. A duplicate surface water sample, one field blank, one trip blank, and two equipment rinsate blanks (one for groundwater, one for sediments) were collected for quality control samples.

Appendix A, SAR Tables I and II, list the samples collected, the analyses requested, location, rationale, and field measurements. The sample locations are illustrated on Figures 1-5 and the analytical results are summarized in Tables 1-8.

Analyses were performed by the EPA Contract Laboratory Program (CLP) Routine Analytical Services (RAS) and Unique Laboratory Sample Analyses (ULSA). All sample results are included in Appendix D: Validation Reports and Laboratory Data Forms.

The DMG sampling activities in Cement Creek included the collection of 102 samples, including 43 surface water, 14 aqueous sources (draining mines) and 45 solid source (mine dump) characterization, and 4 duplicate samples. Appendix B, Tables I-IV, list the samples collected, the analyses requested, location, rationale, and field measurements. Analytical results are summarized in Tables 2-6, herein. DMG aqueous sample analyses, conducted by the EPA lab in Denver, were analyzed for total and dissolved metals (Tables 2, 4 & 5). The solid source field leachate (diluted with 3x volume of water, agitated, let stand for a minimum of two hours, then leachate decanted) samples were analyzed in the field for ph, specific conductivity, total acidity and sulfate. Lab

analyses of the decanted leachate were conducted by the Colorado School of Mines laboratory for total metals. Results are presented in Appendix C.

Flow measurements were obtained for most surface water locations and mine drainages. Global Positioning (GPS) readings were taken for all sample locations. Metals loading calculations were performed for each aqueous sample where flow measurements were obtained (Table 6).

2.0 SITE DESCRIPTION

This investigation encompasses Cement Creek and its tributaries: Prospect Gulch, North Fork, Middle Fork, Minnehaha Creek and the South Fork of Cement Creek. The City of Silverton is situated at an elevation of 9,305 feet above mean sea level (M.S.L.). Cement Creek originates about seven miles north and west of Silverton, near the San Juan County line at approximately 13,000 feet above M.S.L. Historic mining in the area took place throughout Prospect Gulch and Cement Creek Basins.

The discovery of gold in Arrastra Gulch brought miners to the Silverton area in the early 1870's. The discovery of silver in the base-metal ores was the major factor in establishing Silverton as a permanent settlement. Between 1870 and 1890, the richer ore deposits were discovered and mined to the extent possible. Not until 1890 was any serious attempt made to mine and concentrate the larger, low-grade ore bodies in the area. The North Star mine constructed a mill on Sultan Mountain (approximately 1 mile southwest of Silverton) and between 1894 and 1897; a nearby matte smelter processed up to 100 tons of ore per day (CDH, 1994a).

The Kendrick and Gelder (K&G) smelter was built near the mouth of Cement Creek in 1900 and operated during the summer months until 1905. Regional low-grade ores containing gold, silver, lead and zinc were processed at 12 concentration mills in the valley, and further refined at the K&G smelter. Approximately 5,500,000 pounds of copper matte from the upper levels of the Henrietta mine, located in Prospect Gulch, were generated at the K&G smelter. The K&G Smelter was operated by the Ross Mining and Milling Company in 1906 and 1907, chiefly for copper ores from its mines. Mining and milling slowed down around 1905, and mines were consolidated into fewer larger operations with the facilities for milling large volumes of ore (CDH, 1994a).

The Cement Creek basin contains many historic mines. The Queen Anne Mine, Ross Basin (unnamed) Mines, Mogul Mine, South Mogul Mine, and the Red and Bonita Mine are located in upper Cement Creek Basin. The Sunnyside Gold Company's Sunnyside Mine, located approximately 5.5 miles up Cement Creek near Gladstone, began operations in 1959, mining copper, lead, zinc, silver and gold. The Gold King Mine complex is located in the North Fork of Cement Creek. The Lead Carbonate Mill is located in the Minnehaha Creek basin. The Black Hawk Mine is located in the Middle Fork, whereas the Silver Ledge Mine is located in the South Fork. (DMG, 1995a&b).

A Preliminary Assessment was conducted on the Kendrick & Gelder Smelter by the Colorado Department of Health in 1994 (CDH, 1994a). Site Investigations and related surface water sampling was conducted at both the Sunnyside Mine at Gladstone, in Cement Creek Basin, as well as at the Mayflower Mill, located approximately 1.5 miles north of Silverton, by the CDH in 1984. Surface water sampling of Cement Creek, fifty feet above and below the Sunnyside Mine, above the confluence with South Fork, indicated concentrations of heavy metals including cadmium, lead and sliver, above drinking water standards (CDH, 1984a&b).

Prospect Gulch and Cement Creek were included in the *Animas River Targeting Project*, initiated by the CDPHE Water Quality Control Division in 1991. The project consisted of monitoring the chemical, physical and biological health of the Upper Animas River Basin to determine what improvements to aquatic life uses might be attained. Synoptic water quality monitoring at 200 sites within the Upper Animas, Cement and Mineral Creek basins was conducted on four occasions: September, 1991; June 1992; October 1992; and July 1993. Biological assessments, conducted at selected sites in the upper basin in October, 1992, found that aquatic life is not supported in the Cement Creek basin (as well as in Animas River above Maggie Gulch, and the mainstem and Middle Fork of Mineral Creek). Lack of aquatic life is attributable to both natural and anthropogenic factors contributing to dissolved aluminum, cadmium, copper, and zinc present in the Animas River basin at concentrations acutely and chronically toxic to most forms of aquatic life. Additionally, ferric iron, coming from Cement Creek (and Mineral Creek) forms a deposit on the Cement Creek stream bed as well as in the Animas River between Cement Creek and Elk Creek, further inhibiting aquatic life (CDPHE, 1994).

The Bureau of Reclamation conducted Fish Tissue Analyses as part of their 1992 *Animas River Toxicity Study*. Fish were collected from the Animas River from approximately 1/4 mile above Elk Creek (approximately 6 miles below Silverton) to the Colorado/New Mexico State line in April, 1992 and analyzed in June of 1992. Results of this study were included in the October, 1995 *Animas Discovery Report* prepared by CDPHE for EPA (CDPHE, 1995b).

During September-October, 1994, the U.S. Geological Survey, in cooperation with the CDPHE analyzed drainage from natural springs for comparison with mine drainage, in Ohio and Topeka Gulches, tributaries to Cement Creek. Mines had similar concentrations and loads of dissolved metals compared to naturally occurring springs and streams in Topeka Gulch (USGS, 1995).

Sunnyside Gold Corporation (SSG) has been monitoring both natural seeps and mine drainages (the Mogul, South Mogul, Red & Bonita, Black Hawk and Silver Ledge Mines) near the Sunnyside Mine (American Tunnel) in preparation to seal the American and Terry Tunnels. The sites have been monitored during high flow (June/July) and low flow (September/October) for flow and dissolved copper, iron, lead, manganese and zinc prior to plugging the portals for comparison to post-closure water quality.

As a component of plugging the portals, SSG would like to terminate Colorado Discharge Permit System (CDPS) Permits Numbered CO-0027529 (American T.) and CO-0036056 (Terry T.). SSG has reached an agreement with the CDPHE wherein SSG will treat a portion of Cement Creek streamflow until the mine pool has reached equilibrium, and mitigate 6 mine sites in an effort to maintain water quality in the Animas River at a point below the confluence with Mineral Creek (reference point). SSG will monitor (monthly) and treat any remaining flow from the American and Terry Tunnels as well as Cement Creek both above and below treatment until treatment ceases; seeps and adits during high and low flow; receiving streams above and below any water flowing from four of the six mitigation projects (four times a year, at least one at high flow and at least two at low flow) for one year prior to and two years following remediation; and every other month at the Animas River above its confluence with Cement Creek; Cement Creek above its confluence with the Animas River; Mineral Creek above its confluence with the Animas River; and, once per month during the project period at the Animas River reference point, below the confluence with Mineral Creek.

The CDPHE will determine that there has been a "Successful Permit Termination Assessment" if: five years have elapsed from the date of valve closure at the American T. property-line plug; and, two years have elapsed since mine pool equilibrium has been reached; and, valves and pipes in the seal in the American and Terry Tunnels have been grouted and hydrologic control and seals eliminating flows from the lower American Tunnel Portal have been completed or water treatment at the American T. has been accepted by another party or parties; and, the six mitigation sites have been completed; and, treatment of Cement Creek has ceased; and, that the reference water quality is being maintained without continued treatment of Cement Creek (District Court, 1996).

3.0 DATA VALIDATION AND INTERPRETATION

The laboratory acquired data were validated by the EPA Environmental Services Assistance Team (ESAT). Validation reports and laboratory data forms can be found in Appendix D. The analytical results, qualifiers, and interpretations are presented in Tables 1,3,6 & 8. The following data qualifiers were assigned:

- "U" - The analyte was not detected. (Qualified by laboratory software).
- "J" - The assigned value is an estimate because the quality control criteria were not met.
- "UJ" - The analyte was not detected and the reported value is estimated because the quality control criteria were not met.
- "B" "BD" - The analyte was detected at a level below the contract required detection limit (CRDL) but above the method detection limit (MDL), therefore the associated value is an estimate. The presence of the compound is reliable.
- "BJ" - The value is estimated because the analyte was detected at a concentration below the CRDL and because the quality control criteria were not met.
- "R" - The data are rejected.
- "NA" - Indicates that the anlayte was not sampled/analyzed for.

Mercury results were rejected for the mine dump samples, as holding times were exceeded.

Analytes present at "elevated" concentrations are highlighted in the summary tables. A concentration is considered to be "elevated" if the following are true:

- The concentration of a particular analyte in a sample is three times greater than the background concentration; and greater than or equal to five times any blank sample concentrations.

- If the analyte is not detected in the background sample, the concentration is greater than the sample quantitation limit for both the sample and the background sample.

4.0 SOURCE CHARACTERISTICS

4.1 Solid Source Samples

A total of 15 solid source samples were collected by CDPHE from major mine waste dumps located throughout the study area along Cement Creek, Prospect Gulch and their tributaries. The 15 solid source samples were collected from the largest mine dumps in the district. The samples were collected from 0-6 inches below the ground surface for most sources. Sample locations are illustrated on Figures 2 through 4. The samples were analyzed for total metals and the results are summarized in Table 1. DMG filed leachate and laboratory analytical results of 45 solid source samples are presented in Appendix C.

These data show that large volumes of source material containing high metals concentrations are available for release to surface waters.

4.2 Aqueous Source Samples

DMG collected 14 aqueous source samples from draining mines in the basin. These samples were analyzed for total and dissolved metals; total metals are presented in Table 2; total and dissolved metals are presented in Appendix C. The results indicate that all of the adits exhibit high concentrations of several analytes. The rate of discharge from these sources ranges from 1% to 50% of the flow in the receiving streams.

5.0 SURFACE WATER PATHWAY

Previous studies have documented the release of metal contaminants to surface water in Cement Creek, Prospect Gulch and tributaries, and the Animas River. Primary targets within 15 downstream miles of known sources include fisheries, wetlands, and threatened and endangered species habitats.

Cement Creek, including all tributaries, from the headwaters to its confluence with the Animas River are classified for recreation 2 and agriculture. The Animas River from a point immediately above the confluence with Cement Creek to a point immediately above the confluence with Mineral Creek is classified as recreation 2. Existing ambient metals standards (as of February 15, 1995) for these stream segments have been adopted by the Colorado Water Quality Control Commission (WQCC) until further consideration, scheduled for 2001.

Cement Creek, Prospect Gulch and tributaries are devoid of fish due to metals loading. Minimal aquatic life is supported in the Animas River from its confluence with Cement Creek to Elk Park, located approximately 6 miles downstream of Silverton (CDPHE, 1995).

Silverton obtains its municipal drinking-water from Boulder Creek, a tributary to the Animas River, located approximately 1 mile north of the Cement Creek Confluence with the Animas River, and up gradient of the Sunnyside Gold Mill tailings (CDPHE, 1995b).

Federally listed endangered species habitat that could occur at or visit the area include the Northern Goshawk (*Accipiter gentilis*) and the Boreal Toad (*Bufo borealis*) (USFWS, 1995).

Numerous large mine waste rock piles and smaller tailings pile sources have been identified throughout the basin which are uncontained with respect to the surface water pathway. In addition, numerous draining mine adits discharge into the receiving streams in the basin.

5.1 Surface Water and Sediment Sample Locations

Sample locations are illustrated on Figures 1-4. Appendix A, Tables I and II, and Appendix B, Tables I-IV, provide a summary of the samples collected and the analyses performed. A total of 45 aqueous (SW) and collocated sediment (SE) surface water samples were collected for this investigation by DMG and CDPHE, respectively. All aqueous samples were analyzed for total and dissolved metals. All sediment samples were analyzed for total metals. Six pairs (SW and SE) of surface water samples were analyzed for organics and cyanide; six surface water samples were also analyzed for Total Organic Carbon (Table 3).

5.2 Surface Water and Sediment Analytical Results

Surface water analytical results are summarized in Tables 3 through 6. Dissolved (Table 5) and total (Table 4) metals results for aqueous surface water samples compare favorably, i.e. total concentrations generally exceed dissolved concentrations. Table 7 presents the total metals concentrations for sediment samples. Table 3 presents the surface water and sediment organic analytes. "Elevated" concentrations (as defined in section 3.0) are highlighted in the tables.

High concentrations of metals were detected in the headwaters of Cement Creek, increasing noticeably following the introduction of mine drainage from the Queen Anne and Ross basin draining mines. Metals concentrations decrease as Cement Creek progresses downstream, especially notable following treatment of the American Tunnel and a portion of Cement Creek by Sunnyside Gold Corporation. Loading tends to increase as Cement Creek flows downstream, however, with obvious pulses of increased loading below the Queen Anne Mine, Mogul and South Mogul Mines, Red & Bonita Mine, locations below the American Tunnel, below the confluence with South Fork, below the confluence with Dry Gulch, below the confluence with Prospect Gulch and below the confluence with Georgia Gulch.

As identified in Table 4, total concentrations of aluminum, copper, iron, lead, mangnese and zinc in Cement Creek were "elevated", i.e., three times greater than background for every downstream sampling location. Total concentrations of aluminum, beryllium, cadmium, chromium, cobalt, copper, iron, manganese, nickel and zinc below the Gold King Mine were elevated above background in the North Fork of Cement Creek. Total metal concentrations of both downstream locations in the South Fork of Cement Creek, i.e., below the Silver Ledge and Big Colorado Mines, were elevated above background for aluminum, cadmium, cobalt, copper, iron, lead, manganese, and zinc.

Table 6 contains total metal loading in Cement Creek for aluminum, cadmium, copper, iron, lead, manganese and zinc. A series of Bar Graphs, Figures 6-27, graphically present total loadings calculations for these analytes, comparing them to stream acidity and sediment concentrations in each location.

Metals Loading analyses, presented in Table 6 and Figures 9, 13, 15, 19, 23, 25 and 27 reveal that the mines in the upper basin, i.e., the Queen Anne, Hemrietta and Mogul Mines, contribute significantly to the metal loadings in upper Cement Creek. Mines in the Lower Basin, however, contribute only a small portion to the increasing metals loadings in Cement Creek as it flows toward the Animas River, except for a pulse of increased loading below Georgia Gulch, where the Kansas City Mines are located.

The discharge from the American Tunnel as well as flow from Cement Creek at the American Tunnel is actively treated by Sunnyside Gold Corporation. The treated tunnel discharge and creek waters are returned to the Cement Creek channel immediately above sample location CC-SW/SE-24. The American Tunnel drainage was not sampled. The treatment of the American Tunnel causes a drastic rise in pH at the sampling location immediatley downstream. Total iron, lead and manganese loadings significantly increase at this location.

Total metal concentrations of all downstream locations in Prospect Gulch were elevated above background for aluminum, cobalt, copper, iron, lead, manganese, and zinc, increasing in pulses following: introduction of the Galena Queen Mine in the headwaters; the confluence with tributaries contributing acid rock drainage; and, after the introduction of the Hemrietta mine.

Cadmium, copper and zinc loadings increase in the upper basin, remain constant throughout the middle and lower basin, while slightly decreasing between the treatment of the American Tunnel/Cement Creek (CC-SW-33) and the confluence with Prospect Gulch (CC-SW-26), and increasing below Gorgia Gulch and the Kansas city mines. Loading of aluminum, iron, lead and manganese increases as Cement Creek progresses downstream, with notable increases downstream of the American Tunnel/Cement Creek treatment location (CC-SW-33), as well as below the confluence with Prospect Gulch (CC-SW-26), and below Grogia Gulch (CC-SW-29).

Review of Figures 9, 10, 11, 13, 15, 19, 20, 21, 23, 25 and 27, indicate that in the upper Cement Creek basin, the draining mine sources contribute significantly to the metal loadings, as the draining mines constitute as much as 50% of the flows measured in the receiving streams. As the flows increase downstream, however, metal loading contribution from the draining mine sources appears to be insignificant, although metals loading continues to increase.

Metals loadings increase as Prospect Gulch progresses downstream, with significant increases calculated below the Galena Queen Mine, below the mineralized tributaries, and again below the Henrietta Mine complex.

As generally depicted in these graphs, there is a positive correlation between stream acidity and metals loading in the surface water, negatively correlated to the sediment concentrations. This is especially noticeable in Cement Creek below Gladstone, following the treatment of the American Tunnel and a portion of Cement Creek, where draining mine contribution to the increased metal loading is insignificant. It may be interpreted that as stream acidity increases, metals in the sediment are mobilizing into the surface water column, increasing the metal loading in the surface water, consequently decreasing metals concentrations in the sediments. Naturally mineralized areas as well as non-point sources of pollution, i.e., potential mineral contribution from water contacting mine waste piles, may also contribute to metal loading.

For aquatic life, the primary metals of concern are cadmium, lead, and zinc. These metals are widespread and are frequently present at concentrations which greatly exceed the Ambient Water Quality Criteria for surface waters found in the Superfund Chemical Data Matrix (SCDM) (Cadmium 1.1, Lead 3.2, and Zinc 110, values in micrograms per liter).

As presented in Table 7, "elevated" concentrations in sediment samples were observed for antimony and magnesium downstream of the background sample to a location below Corkscrew Gulch and the ferricrete deposit on the mainstem of Cement Creek (SE-8). Vanadium is elevated for most of the downstream sampling locations. Mercury was measured at above detection, and therefore elevated compared to background below the Red & Bonita Mine (SE-9). Antimony and zinc become elevated at the locations immediately below the confluence with Dry Gulch (SE-25) and below the confluence with Prospect Gulch (SE-26). Copper is elevated in Cement Creek below the confluence with Dry Gulch (SE-25). Elevated metals concentrations for sediment samples occurred at a lower frequency than that of aqueous samples,

All surface water and sediment samples analyzed for cyanide were found to be non-detect. Surface water samples analyzed for organics were found to be non-detect, except that Methylene chloride was found at low levels (2ug/L) in two surface water samples (CC-SW-24, Cement Creek below the confluence with South Fork and PG-SW-03, Prospect Gulch below the Galena Queen Mine) and three of the rinsate samples; one surface water sample contained a low concentration of acetone (CC-SW-24 @ 3ug/L). Three sediment samples were also found to contain low concentrations of methylene chloride (CC-SE-06, Cement Creek below the Mogul Mines @ 4ug/kg; CC-SE-12, the North Fork of Cement Creek below the Gold King Mine @ 4ug/kg; and CC-SE-24, Cement Creek below the confluence with South Fork @10ug/kg) ; one sediment sample was found to contain low concentrations of acetone (CC-SE-24 @ 7 ug/kg). Organic compound analytical results are presented in Table 3.

Methylene chloride and acetone are common laboratory contaminants. Methylene chloride is widely used by consumers, of which about 30% of the annual production (300,000 tons) is used in paint strippers and removers, with another 20% used in aerosol finishes, often in hairspray. EPA standard for drinking water is 150 ug/L; FDA standards for foods are: 10,000 ppb in decaffeinated coffee; 30,000 ppb in spice extracts; and, 220,000 ppb in brewing hops. OSHA limit in the workplace air is 100,000 ppb. (Harte, et.al., 1991).

Acetone is a widely used industrial solvent, and commonly used in the home in the form of fingernail polish remover, and glue. It is used in the production of lubricating oils, other industrial chemicals such as chloroform and acrylics. Nearly half of all acetone manufactured is used to make acrylic plastics. The FDA limits in spice extracts is 30,000 ppb. OSHA limit in the workplace is 750,000 ppb. Acetone can be smelled by most people when concentration in the air reaches 500,000 ppb; a concentration of 20,000,000 ppb in the air is considered dangerous (Harte, et. al., 1991).

5.3 Surface Water Analytical Results by Stream Segment

5.3.1 Upper Cement Creek (SW/SE-01 through SW/SE-9)

As illustrated in Tables 4-5, the Upper Cement Creek surface water sample below the Queen Anne Mine (CC-SW -2) exhibited elevated concentrations of total and dissolved aluminum, cadmium, copper, manganese, nickel, and zinc, compared to the background surface water sample (CC-SW-1). Table 7 presents sediment samples as this location (CC-SE-2) exhibiting elevated concentrations in antimony, magnesium and vanadium, when compared to the background sediment sample (CC-SE-1). As shown in Table 6 the Upper Cement Creek surface water sample below the Queen Anne Mine (CC-SW -2) exhibited increased loading of total aluminum, barium, cadmium, copper, iron, lead, manganese, nickel, and zinc, compared to the background surface water sample (CC-SW-1).

The Ross Basin tributary surface water sample below the Unnamed Mine (CC-SW-4) exhibited elevated concentrations of dissolved aluminum; dissolved cadmium; dissolved and total copper, dissolved and total iron; dissolved lead; dissolved and total manganese; and dissolved and total zinc, when compared to the background sample (CC-SW-3). The Ross Basin tributary sediment sample below the Unnamed Mine (CC-SE-4) exhibited elevated concentrations of antimony when compared to the background sample (CC-SW-3), where antimony was not detected. The Ross Basin tributary surface water sample below the Unnamed Mine (CC-SW-4) exhibited increased loading of total aluminum, cadmium, copper, iron, manganese and zinc, when compared to the background sample (CC-SW-3). It is interesting to note that sediment concentrations of barium, beryllium, cadmium, copper, lead, magnesium, manganese, nickel, thallium and zinc decreased when compared to sediment concentrations measured in the background sample (CC-SE-3)

The surface water sample above the Mogul Mines (CC-SW-5) exhibited elevated concentrations in total and dissolved aluminum, cadmium, copper, manganese and zinc and total iron and lead, as well as dissolved sodium when compared to the background sample (CC-SW-1). The sediment sample above the Mogul Mines (CC-SE-5) exhibited elevated concentrations of total antimony, magnesium and vanadium when compared to the background sample (CC-SE-1). Loading at CC-SW-5 is the sum of loading measured at CC-SW-2 and CC-SW-4 plus an unknown contributing source, causing an increased loading of total aluminum, barium, cadmium, copper, iron, lead, manganese, and zinc. It is interesting to note that sediment concentrations of arsenic, barium, beryllium, cadmium, lead, and zinc decreased when compared to sediment concentrations measured in the background sample (CC-SE-1).

The surface water sample below the Mogul Mines (CC-SW-6) exhibited elevated concentrations in total and dissolved aluminum, cadmium, copper, manganese and zinc, as well as total iron, and lead, and dissolved sodium when compared to the background sample (CC-SW-1). Total Organic Carbon was measured at less than 1 mg/L at this location. Surface water and sediments at this location were analyzed for organic compounds. Methylene chloride was the only organic compound found in measurable concentrations (4ug/kg) in the sediment sample. No organic compounds were detected in the surface water sample.

The sediment sample below the Mogul Mines (CC-SE-6) exhibited elevated concentrations of total antimony, magnesium and vanadium when compared to the background sample (CC-SE-1). Loading at CC-SW-6 is the sum of loading measured at CC-SW-5 and SO-5, the Mogul Mine drainage, plus an unknown contributing source, causing an unaccounted increase in ding of total aluminum, barium, cadmium, copper, manganese, and zinc. It is interesting to note that sediment concentrations of copper, lead, and manganese decreased when compared to sediment concentrations measured in the immediate upstream sample (CC-SE-5).

The surface water samples above (CC-SW-7) and below (CC-SW-8) the confluence with Corkscrew Gulch and the Ferricrete deposit exhibited elevated concentrations in total and dissolved aluminum, cadmium, copper, iron, lead, manganese and zinc, as well as dissolved sodium when compared to the background sample (CC-SW-1). The sediment sample above Corkscrew Gulch and the Ferricrete deposit (CC-SE-7) exhibited elevated concentrations of total magnesium and vanadium when compared to the background sample (CC-SE-1). The sediment sample below Corkscrew Gulch and the Ferricrete deposit (CC-SE-8) exhibited elevated concentrations of total antimony and vanadium when compared to the background sample (CC-SE-1). Loading at CC-SW-7 and CC-SW-8 generally remained constant or exhibited minor decreases when compared to the immediate upstream sample (CC-SW-6). The same trend was observed in the sediment concentrations at these locations.

The surface water sample below the Red & Bonita Mines (CC-SW-9) exhibited elevated concentrations in total and dissolved aluminum, cadmium, copper, iron, lead, manganese and zinc, as well as dissolved potassium and sodium when compared to the background sample (CC-SW-1). The sediment sample below the Red & Bonita Mines (CC-SE-9) exhibited elevated concentrations of total mercury, when compared to the background sample (CC-SE-1), where it was not detected. This is the only location where mercury was found in sediments at a detectable concentration.

Increased loading at CC-SW-9 below the Red & Bonita mine was calculated for total aluminum, barium, cadmium, copper, iron, manganese, and zinc. It is interesting to note that sediment concentrations of all metals analyzed, with the exception of mercury, silver and sodium decreased when compared to sediment concentrations measured in the immediate upstream sample (CC-SE-8).

5.3.2 The North Fork of Cement Creek (SW/SE 10 and SW/SE 12) Cement Creek's Confluence with the North Fork (SW/SE-9 and SW/SE-13) and Cement Creek Below the Treatment of the American Tunnel (CC-SW-33)

The surface water sample below the Gold King Mine (CC-SW-12), located in the North Fork of Cement Creek, exhibited elevated metal concentrations of total: aluminum, beryllium, cadmium, chromium, cobalt, copper, iron, manganese, nickel and zinc, when compared to the background sample (CC-SW-10). Dissolved analyses were not conducted. Loading was not calculated, as flow was not measured in the background sample. The sediment sample below the Gold King Mine (CC-SE-12) exhibited elevated concentrations of antimony, arsenic, lead, selenium, and silver, when compared to the background sediment sample (CC-SE-10). Surface water and sediments at this location were analyzed for organic compounds. Methylene chloride was the only organic compound found in measurable concentrations (4ug/kg) in the sediment sample. No organic compounds were detected in the surface water sample. Total Organic Carbon was measured at 1 mg/L in the surface water sample.

The surface water sample in Cement Creek below the confluence with the North Fork (CC-SW-13) exhibited elevated concentrations of total and dissolved aluminum, cadmium, copper, iron, lead, manganese and zinc as well as dissolved chromium, nickel, sodium and vanadium, when compared to the Cement Creek background sample (CC-SW-1). The Cement Creek sediment sample below the confluence with the North Fork (CC-SE-13) exhibited elevated concentrations of vanadium when compared to the background sediment sample (CC-SE-1). Total metal loadings calculated at this location were less than those measured at the sampling location immediately upstream (CC-SW-9). The reverse trend wast noted for sediment samples taken at the same locations, i.e., sediment concentrations were higher in the sample below the confluence with the North Fork than that of the next immediate upstream sample, with the exception of mercury, silver and sodium.

The surface water sample in Cement Creek below the American Tunnel treated effluent (CC-SW-33) exhibited elevated concentrations of total and dissolved aluminum, copper, iron and manganese as well as dissolved calcium and sodium; and total lead and zinc, when compared to the Cement Creek background sample (CC-SW-1). Metal loadings downstream of the American Tunnel treated effluent either increased or decreased by the following amounts, compared to the immediate upstream sample (CC-SW-13): aluminum increased by 16%; barium increased by 24%; cadmium decreased by 48%; copper decreased by 73%; iron increased by 610%; lead increased by 408%; manganese increased by 595%; and zinc decreased by 33%. The American treated effluent was not analyzed; therefore, contribution from the Tunnel was not able to be determined. It is of interest to note that with exception of cadmium, calcium and selenium, total metal concentrations of the sediment sample below the American Tunnel were 33%-50% less than that measured at the sampling location immediately upstream (CC-SW-13), perhaps accounting for some of the increased loading. Calcium concentrations increased by 232%.

5.3.3 Cement Creek's Confluence with the South Fork (CC-SW/SE-33 and CC-SW/SE-24); South Fork of Cement Creek (CC-SW/SE-21 through CC-SW/SE-23) and tributaries: Minnehaha Creek (CC-SW/SE-14 and CC-SW/SE-15) Middle Fork of Cement Creek (CC-SW/SE-17 through CC-SW/SE-20) and Cement Creek below the confluence with Dry Gulch (CC-SW-25)

The background surface water sample above the Lead Carbonate Mill (CC-SW-14), located in **Minnehaha Creek**, tributary to the South Fork of Cement Creek, was unable to be sampled as it was dry; the sampling team decided not to collect a sediment sample there as well. However, total and dissolved metals concentrations in the surface water sampled below the Lead Carbonate Mill (CC-SW-16) were high for aluminum; cadmium; copper; iron; the highest concentration of total and dissolved lead of all the surface water sampled; manganese and zinc. The surface water sample below the Lead Carbonate Mill (CC-SW-16) exhibited decreased total and dissolved metal concentrations and loading of total metals, with the exception of total cobalt, when compared to the sample immediately upstream (CC-SW-15).

The sediment samples taken below the Lead Carbonate mine at the mouth of Minnehaha Creek, above its confluence with the South Fork (CC-SE-16), exhibited elevated concentrations of aluminum, beryllium; cobalt; magnesium; manganese; nickel; selenium and vanadium, when compared to the sediment sample taken below the Lead Carbonate Mill (CC-SE-15), where beryllium and selenium were not detected.

The background surface water sample above the Black Hawk Mine (CC-SW-17), located in **Middle Fork**, tributary to the South Fork of Cement Creek, was unable to be sampled, as it was dry; a sediment sample was collected at this location, however. Total and dissolved metals concentrations in the surface water sampled below the Black Hawk Mine (CC-SW-19) were high for iron, manganese and zinc. Sediment concentrations measured below the Unnamed Waste Rock Pile (CC-SE-18) and below the Black Hawk Mine (CC-SE-19) decreased relative to the background sample (CC-SE-17).

The surface water sample at the mouth of Middle Fork, before its confluence with South Fork, (CC-SW-20) exhibited relatively similar or decreasing concentrations of total and dissolved metals compared to the immediate upstream sample (CC-SW-19). With the exception of calcium and zinc, the sediment sample at this location also exhibited decreasing concentrations of total metals when compared to the background sample (CC-SE-17).

The surface water sample below the Big Colorado and Silver Ledge Mines (CC-SW-22), located in the **South Fork of Cement Creek**, exhibited elevated metal concentrations of total and dissolved aluminum, cadmium, iron, manganese and zinc; dissolved calcium and magnesium; and total cobalt, copper, lead and vanadium when compared to the background sample (CC-SW-21). Loadings calculated at CC-SW-22 ideally encompass the effects of loadings from the background sample, CC-SW-21, plus drainage form the Silver Ledge (SO-13) and Big Colorado (SO-17) Mines. Aluminum and copper loadings, however, are twice the sum of known contributors, and cobalt loadings are 25% greater that the sum of the parts. Loadings of iron, manganese and zinc, however were less than the sum of the known contributors. Interesting to note, manganese and zinc concentrations in the sediment at CC-SW-22 were also lower than the background sample (CC-SE-21) The remaining metals concentrations in the sediments were higher at this location compared to background.

The surface water sample in South Fork above its confluence with the mainstem of Cement Creek (CC-SW-23) exhibited elevated metal concentrations of total and dissolved aluminum, cadmium, cobalt, copper, iron, manganese and zinc; dissolved calcium, chromium, magnesium, potassium, and vanadium; and total lead when compared to the background sample (CC-SW-21). Loadings calculated at CC-SW-23 ideally encompass the effects of loadings from the immediate upstream sample, (CC-SW-22), the mouth of Minnehaha Creek (CC-SW- 16) and the Middle Fork (CC-SW-20). The flow measured at CC-SW-23 is 14% greater that the sum of the contributing tributaries.

Manganese and zinc loadings, however, are twice the sum of known contributors, cadmium 69% greater, aluminum and cobalt 38% greater, copper 28% greater and barium and lead 19% greater than the sum of known contributors. Iron was 20 % less than the sum of contributors. Interestingly, sediment concentrations of the those metals for which increases in loading at CC-SE-23 were unaccounted for, are considerably lower that the concentrations measured at the mouth of Minnehaha and Middle Fork: aluminum is 50 % lower; barium is ranges between 25 - 45% lower; cadmium is undetected whereas it is measured in the upper samples; cobalt is 80% lower; copper is between 75-80 % lower; lead is between 60-75% lower; manganese is 68-78% lower; and zinc is an order of magnitude less that the sediment concentrations at the upper locations. The decrease in sediment concentrations may account for the unidentified loading contributions.

The surface water sample in **Cement Creek below the confluence with the South Fork** (CC-SW-24) exhibited elevated concentrations of total and dissolved: aluminum, cobalt; copper; iron; and manganese; dissolved calcium, potassium, sodium; and total lead and zinc compared to the Cement Creek background sample (CC-SW-1). Metals loading at this location ideally combine the sum of loadings calculated at the immediate upstream sample (CC-SW-33) plus the contribution from South Fork (CC-SW-23). Although the flow measured at CC-SW-24 is 8% greater than the sum of the two contributors, loadings are generally 10 to 25% less than the combined sum; conversely, sediment concentrations in the downstream sample are generally greater that the average of the two upstream samples. This sediment sample location exhibited elevated vanadium concentrations than the background (CC-SE-1)

Surface water and sediments at this location were analyzed for organic compounds. Methylene chloride and acetone were the only organic compounds found in measurable concentrations (10 and 7 ug/kg, respectively) in the sediment sample. Methylene chloride was also found in the surface water sample at the low concentration of 2 ug/L. Total Organic Carbon was also measured at less than 1 mg/L in the surface water sample. Cyanide was not detected.

The surface water sample in **Cement Creek below the confluence with Dry Gulch (CC-SW-25)** exhibited elevated concentrations of total and dissolved aluminum, cobalt, copper, iron, lead, and manganese; dissolved calcium and sodium; and total zinc when compared to the background sample (CC-SW-1). Loading calculations for CC-SW-25 should combine contributions from the immediate upstream sample (CC-SW-24), the Dry Gulch Adit (SO-24) and Dry Gulch (not sampled). Although the Flows at CC-SW-25 were 25% greater that the upstream sample, loading calculations for total

metals increased by the following: aluminum increased by 222%; barium and cadmium increased by 35%; cobalt increased by 98%; copper increased by 17%; iron increased by 296%; lead increased by 256%; manganese increased by 47%; and zinc increased by 60%. Sediment concentrations for antimony, copper, vanadium and zinc were elevated at this location, relative to the background sample (CC-SE-1).

5.3.4 Prosect Gulch (PG-SW/SE-1 through PG-SW/SE-19) and Cement Creek's Confluence with Prospect Gulch (CC-SW/SE-26 through CC-SW/SE-38)

The surface water sample below the Galena Queen Mine (PG-SW-3), located in the headwaters of Prosect Gulch, a tributary to Cement Creek, exhibited elevated metal concentrations of total and dissolved aluminum, arsenic, cadmium, cobalt, copper, iron, lead, manganese, nickel and zinc, when compared to the background sample (PG-SW-1). Loadings of these same metals increased significantly as well. The sediment sample below the Galena Queen Mine (PG-SE-3), exhibited elevated concentrations of antimony, arsenic, cadmium, copper, lead, mercury, silver, sodium, thallium and zinc, compared to the background sediment sample (PG-SE-1) where antimony, mercury and silver were not detected.

Surface water samples at this location were analyzed for organic compounds. Methylene chloride and acetone were found in low concentrations (@ 3ug/L); these compounds were not analyzed for in the background sample. Cyanide was analyzed and found to be below detection. Total Organic Carbon was measured at 2 mg/L in the surface water sample at this location.

Sediments at PG-SE-4, a tributary to Prospect Gulch were analyzed for organic compounds, yet not detected. Cyanide was detected at a low concentration of 0.14 mg/kg.

The surface water sample below the four mineralized tributaries (PG-SW-8), located in the headwaters of Prosect Gulch, exhibited elevated concentrations of total and dissolved aluminum, cadmium, cobalt, copper; iron, lead, manganese, and zinc; and dissolved calcium, when compared to the background sample (PG-SW-1). With the exception of iron, metal loadings increased at this location, when compared to the immediate upstream sample (PG-SW-3). The sediment samples below the mineralized headwater tributaries (PG-SE-8), exhibited elevated concentrations of beryllium, lead, silver and zinc, compared to the background sediment sample (PG-SE-1) where silver was not detected.

The surface water sample below the mineralized tributary, and above the Henrietta Mine (PG-SW-11), exhibited elevated surface water concentrations for total and dissolved aluminum, cadmium, copper, iron, lead, manganese and zinc, and dissolved calcium, cobalt, and nickel when compared to the background sample (PG-SW-1). Metal loadings decreased when compared to the immediate upstream samples (PG-SW-9 and 10). Sediment concentrations of antimony lead and silver were elevated relative to the background sample; with the exception of aluminum, arsenic, copper and zinc, the sediments at this location exhibited increases in total metals concentrations when compared to the immediate upstream sample (PG-SE-9).

The surface water sample below the Henrietta Mine (PG-SW-16), exhibited elevated surface water concentrations for total and dissolved aluminum, cadmium, cobalt, copper, iron, lead, manganese, nickel and zinc; total arsenic; and dissolved calcium and magnesium when compared to the background sample (PG-SW-1). With the exception of barium, metal loadings significantly increased when compared to the immediate upstream samples (PG-SW-11). Sediment concentrations exhibited only slight increases in concentration, if any, when compared to the immediate upstream sample(PG-SE-11); sediment concentrations of cadmium, lead and silver were elevated when compared to background.

Surface water and sediments at this location (PG-SW/SE-16) were analyzed for organic compounds. Organic compounds were not detected in either the surface water or sediments at this location. Total Organic Carbon was measured at less than 1 mg/L in the surface water sample at this location. Cyanide was not detected in either the surface water or sediments.

The surface water sample below the Joe & John's Mine (PG-SW-18), exhibited elevated surface water concentrations for total and dissolved aluminum, cadmium, cobalt, copper, iron, lead, manganese, nickel and zinc; total arsenic; and dissolved calcium and magnesium, when compared to the background sample (PG-SW-1). Metal loadings slightly decreased when compared to the immediate upstream samples (PG-SW-16), perhaps reflecting dilution from the two tributaries entering Prospect Gulch between the two sampling locations. Sediment concentrations of total aluminum, antimony, chromium, cobalt, iron, manganese, nickel, and potassium exhibited only slight increases in concentration, if any, when compared to the immediate upstream sample (PG-SE-11), whereas the remaining metals exhibited decreasing concentrations. Sediment concentrations of antimony, lead and silver were elevated when compared to background.

Surface water was not sampled at the mouth of Prospect Gulch, before its confluence with Cement

Creek. A sediment sample (PG-SE-19) was collected, however, and exhibit elevated lead and silver concentrations when compared to the background sample (PG-SE-1). Arsenic, iron, vanadium and zinc sediment concentrations were considerably higher at this location when compared to the immediate upstream sample (PG-SE-18); the remaining metals were relatively similar.

The surface water sample in Cement Creek below the confluence with Prospect Gulch (CC-SW-26) exhibited elevated concentrations of total and dissolved aluminum, copper, iron, lead, manganese and zinc; total arsenic, chromium and cobalt; and dissolved calcium, and sodium when compared to the Cement Creek background surface water sample (CC-SW-1). Although the flow increased by only 9% at this location, loadings of total aluminum and cobalt increased by 200%, total copper loading increased by 62% and total iron loading increased by 238%, relative to the upstream sample (CC-SW-25). Significant increases in sediment concentrations of total aluminum, cobalt, copper, and iron were exhibited at this location (CC-SE-26), when compared to the immediate upstream sample (CC-SE-25); the remaining metals were relatively similar between the two samples. Sediment concentrations were elevated for total antimony, vanadium and zinc, when compared to the background sample (CC-SE-1).

The surface water sample in Cement Creek below the confluence with Georgia Gulch (CC-SW-28) exhibited elevated concentrations of total and dissolved aluminum, arsenic, cobalt, copper, iron, lead, manganese, nickel and zinc; and dissolved antimony, beryllium, calcium, magnesium, and sodium compared to the Cement Creek background surface water sample (CC-SW-1). Metals loading of aluminum, arsenic, barium, cobalt, iron, lead, manganese and zinc are significantly greater at this location that at the immediate upstream sample (CC-SW-26), and appears to be much greater than the contributions attributed to the Prospect Gulch adit (SO-18) and the Kansas City Mine (SO-20). Georgia Gulch was not sampled to determine its contribution to the loading at this location. With the exception of manganese and zinc sediment concentrations, which decreased by approximately 35%, metals sediment concentrations remained similar to the immediate upstream sample (CC-SE-26).

The surface water sample in Cement Creek downstream of the adit below Georgia Gulch (SO-19), below the confluence with Fairview and Minnesota Gulches, and above the confluence with Porcupine Gulch (CC-SW-29) exhibits elevated concentrations of total and dissolved aluminum, arsenic, cobalt, copper, iron, lead, manganese, vanadium and zinc; and dissolved calcium, nickel, potassium and sodium when compared to the background sample (CC-SW-1). Loadings at this location are greater than the immediate upstream sample (CC-SW-28). As Fairview and Minnesota Gulches were not sampled it was not determined what their contribution to the loading calculation may be. Sediment concentrations of metals at this location are elevated for magnesium and

vanadium. Iron and zinc concentrations at CC-SE-29 are considerably less at this location at the sample immediately upstream (CC-SE-28). Manganese, on the other hand is approximately three times higher than the upstream sample. The remaining metals sediment concentrations are similar or slightly greater than the sediments concentrations in the immediate upstream sample.

The surface water sample in Cement Creek below the confluence with Porcupine Gulch (CC-SW-31) exhibited elevated concentrations of total and dissolved aluminum, arsenic, copper, iron, lead, manganese and zinc; and dissolved beryllium, calcium, nickel and sodium; as well as total cobalt, when compared to the background sample (CC-SW-1). The flow at this location is 15% lower than the immediate upstream sample, even though Porcupine Gulch flows into Cement Creek. The majority of the total metal loadings, however, range from 20 to 25% lower than the immediate upstream sample (CC-SW-29). Sediment concentrations of chromium, copper, silver, vanadium and zinc are greater than the immediate upstream sample (CC-SE-29); the remaining sediment metals concentrations are lower than, or relatively similar to, the upstream sample.

The surface water sample in Cement Creek above its confluence with the Animas River (CC-SW-48) exhibited elevated concentrations of total and dissolved aluminum, cobalt, copper, iron, lead and manganese; dissolved cadmium, nickel, potassium, and sodium; and total arsenic and zinc, when compared to the Cement Creek background sample (CC-SW-1). The flows at this location are 51% higher than the immediate upstream sample (CC-SW-31); changes in loading relative to the immediate upstream sample range from: iron decreased by 6%; lead increased by 17%; arsenic increased by 31%; aluminum increased by 39%; cadmium increased by 49%; copper increased by 50%; manganese increased by 51%; cobalt increased by 65%; and barium increased by 86%. Sediment concentrations of vanadium were elevated compared to background (SCC-SE-1). Sediment concentrations of arsenic, barium, calcium, cobalt, iron, lead, manganese, potassium, sodium, thallium, and zinc increased relative to the immediate upstream sample (CC-SE-31). The remaining metals were relatively similar to or slightly lower than the upstream sample.

5.3.5 Animas River (CC-A-SW/SE-68 and CC-A-SW/SE-72)

The surface water in the Animas River below the Town of Silverton (CC-A-SW-72), also below the confluence with both Cement and Mineral Creeks, exhibited elevated concentrations of total aluminum, arsenic, copper, iron, and lead; and dissolved iron, when compared to the Animas River above Cement Creek (CC-A-SW-68). Loading at CC-SW-A-72 should reflect the combined sources of the Animas River above Cement Creek (CC-SW-A-68), Cement Creek (CC-SW-CC48) and Mineral Creek (CC-SW-M34). The flow at CC-SW-A-72 is approximately 3% greater than the contributing sources. Iron loadings decreased by 10%, lead loadings decreased by 8.5% and zinc loadings decreased by 5% when compared to the Animas River above Cement Creek (CC-SW-A-68). The remaining metals loadings were similar to or slightly greater that the upstream sample. Sediment concentrations for aluminum, antimony, arsenic, barium, beryllium, calcium, chromium, cobalt, iron, magnesium, manganese, selenium, and vanadium were higher CC-SE-A-72 than the sample taken from the Animas River above Cement Creek (CC-SE-A-68). The remaining metals were similar to or slightly less than the upstream sample. Concentrations of silver at CC-SE-A-72 sere elevated relative to the sample taken form the Animas River above Cement Creek(CC-SE-A-68).

6.0 <u>SOIL EXPOSURE, AIR, AND GROUND WATER PATHWAYS</u>

The risk posed to human health or the environment by the on-site pathway for the sources identified is considered to be minimal. There are no persons living on-site or within 200 feet of any of the identified sources. The sources located along Cement Creek, Prospect Gulch and their tributaries are greater than 1-mile from the nearest residents.

The risk posed to human health or the environment by the air pathway for the sources identified is also considered to be minimal. Although the sources located along Cement Creek, Prospect Gulch and their tributaries are uncovered and access is not restricted, these sources are located more than 1-mile from the nearest residents.

Three ground water wells and two surface water sources used for drinking water were sampled as part of this SI. One well is located in on the mainstem of the Animas River, approximately 1 mile above Howardsville (GW-3); one well is located up Cement Creek, approximately 1 mile below the confluence with Prospect Gulch (GW-1); one well is located along Mineral Creek, approximately 1

mile above its confluence with the Animas River (GW-5). Two surface water sources are used for drinking water: a summer residence utilizing filtered surface water from the Middle Fork of Cement Creek, below the Silver Ledge Mine; the other, the Lenore Load, a draining mine adit located in Cunnignham Gulch, filtered and used by vacationers in their travel trailer for two weeks each summer.

Drinking water samples were collected prior to any in-home filtration system and analyzed for total and dissolved (filtered using a 0.45 micron membrane filter) metals. Results are presented in Table 8.

Total lead concentrations in the Cement Creek Well (GW-1), and both total and dissolved lead concentrations in the Lenore Load adit (GW-4) and the Mineral Creek Well (GW-5) exceed the EPA recommended action level of 15 ug/l. The Lenore lode adit (GW-4) total and dissolved cadmium concentrations exceed EPA's recommended action level of 5ug/L. Except for the Lenore lode adit, the remaining drinking water samples had manganese concentrations ranging between 352 to 2130 ug/L; well above the current EPA Action Level of 200 ug/l. The groundwater well above Howardsville (GW-3) was the only site with manganese concentrations above the CDPHE health based advisory of 800 ug/l.

Letters have been sent to each of the drinking water users providing them with the analytical results. Retesting of each well/surface water was offered to each household, such that samples could be taken to determine the effectiveness of any in-home filtration system to remove cadmium, lead or manganese. In those instances where the lead and cadmium concentrations exceeded drinking water standards or action levels, the users were advised not to consume the water without adequate filtration.

Additionally, the letters informed the residents that recent toxicological studies indicate that concentrations of manganese in drinking water of 800 ppb or less is considered acceptable, and that although EPA has not set a primary drinking water standard for manganese, they have set a secondary drinking water standard of 50 parts per billion, based on taste rather than possible adverse health affects. In the one instance where the manganese concentration exceeded the 800 ppb health based advisory, i.e., the well located along the Animas River above Howardsville (GW-3), it was recommended that the well water not be consumed without adequate filtration. Copies of the letters sent are included in Appendix E.

7.0 SUMMARY AND CONCLUSIONS

Source samples collected from the major mine dumps located throughout the district indicate that large volumes of both aqueous (draining mine adits) and solid source (Mine waste piles) material containing high metals concentrations are available for release to surface waters.

A total of 53 aqueous (SW) and collocated sediment (SE) surface water samples were collected for this investigation by DMG and CDPHE, respectively. All aqueous samples were analyzed for total and dissolved metals. All sediment samples were analyzed for total metals. Six pairs (SW and SE) of surface water samples were analyzed for organics and cyanide; six surface water samples were also analyzed for Total Organic Carbon. Five drinking water (3 groundwater and 2 surface water) samples were collected and analyzed for total and dissolved metals. Stream flow measurements allowed for metals loading calculations for all surface water and aqueous source locations.

High concentrations of metals were detected in the headwaters of Cement Creek, increasing noticeably following the introduction of mine drainage from the Queen Anne and Ross basin draining mines. Metals concentrations decrease as Cement Creek progresses downstream, especially notable following treatment of the American Tunnel and a portion of Cement Creek by Sunnyside Gold Corporation. Loading tends to increase as Cement Creek flows downstream, however, with obvious pulses of increased loading below the Queen Anne Mine, Mogul and South Mogul Mines, Red & Bonita Mine, and at locations below the American Tunnel, below the confluence with South Fork, below the confluence with Dry Gulch, below the confluence with Prospect Gulch and below the confluence with Georgia Gulch.

Concentrations of total aluminum, copper, iron, lead, mangnese and zinc in **Cement Creek** were "elevated", i.e., three times greater than background (CC-SW-1) for every downstream sampling location. Total concentrations of aluminum, beryllium, cadmium, chromium, cobalt, copper, iron, manganese, nickel and zinc below the Gold King Mine were elevated above background (CC-SW-10) in the **North Fork** of Cement Creek. Total metal concentrations of both downstream locations in the **South Fork** of Cement Creek, i.e., below the Silver Ledge and Big Colorado Mines, were elevated above background (CC-SW-21) for aluminum, cadmium, cobalt, copper, iron, lead, manganese, and zinc. Total metal concentrations of all downstream locations in **Prospect Gulch** were elevated above background (PG-SW-1) for aluminum, cobalt, copper, iron, lead, manganese, and zinc, increasing in pulses following: introduction of the Galena Queen Mine in the headwaters; the confluence with tributaries contributing acid rock drainage; and, after the introduction of the Hemrietta mine.

Metals Loading analyses reveal that the mines in the upper basin, i.e., the Queen Anne, Hernrietta and Mogul Mines, contribute significantly to the metal loadings in upper Cement Creek. Mines in the Lower Basin, however, contribute only a small portion to the increasing metals loadings in Cement Creek as it flows toward the Animas River, except for a pulse of increased loading below Georgia Gulch, where the Kansas City Mines are located.

Cadmium, copper and zinc loadings increase in the upper basin, remain constant throughout the middle and lower basin, while slightly decreasing between the treatment of the American Tunnel/Cement Creek (CC-SW-33) and the confluence with Prospect Gulch (CC-SW-26), and increasing below Gorgia Gulch and the Kansas city mines. Loading of aluminum, iron, lead and manganese increases as Cement Creek progresses downstream, with notable increases downstream of the American Tunnel/Cement Creek treatment location (CC-SW-33), as well as below the confluence with Prospect Gulch (CC-SW-26), and below Grogia Gulch (CC-SW-29).

Draining mine sources in the upper Cement Creek basin contribute significantly to the metal loadings, as the draining mines constitute as much as 50% of the flows measured in the receiving streams. As the flows increase downstream, however, metal loading contribution from the draining mine sources appears to be insignificant, although metals loading continues to increase.

The discharge from the American Tunnel as well as flow from Cement Creek at the American Tunnel is actively treated by Sunnyside Gold Corporation. The treated tunnel discharge and creek waters are retumed to the Cement Creek channel immediately above sample location CC-SW/SE-24. The American Tunnel drainage was not sampled. The treatment of the American Tunnel causes a drastic rise in pH at the sampling location immediatley downstream. Total iron, lead and manganese loadings significantly increase at this location.

There is a positive correlation between stream acidity and metals loading in the surface water, negatively correlated to the sediment concentrations. This is especially noticeable in Cement Creek below Gladstone, following the treatment of the American Tunnel and a portion of Cement Creek, where draining mine contribution to the increased metal loading is insignificant. It may be interpreted that as stream acidity increases, metals in the sediment are mobilizing into the surface water column, increasing the metal loading in the surface water, consequently decreasing metals concentrations in the sediments. Naturally mineralized areas as well as non-point sources of pollution, i.e., potential mineral contribution from water contacting mine waste piles, may also contribute to metal loading.

Metals loadings increase as Prospect Gulch progresses downstream, with significant increases calculated below the Galena Queen Mine, below the mineralized tributaries, and again below the Henrietta Mine complex.

For aquatic life, the primary metals of concern are cadmium, lead, and zinc. These metals are widespread and are frequently present at concentrations which greatly exceed the Ambient Water Quality Criteria for surface waters found in the Superfund Chemical Data Matrix (SCDM) (Cadmium 1.1, Lead 3.2, and Zinc 110, values in micrograms per liter).

"Elevated" concentrations in sediment samples were observed for antimony and magnesium downstream of the background sample to a location below Corkscrew Gulch and the ferricrete deposit on the mainstem of Cement Creek (SE-8). Vanadium is elevated for most of the downstream sampling locations. Mercury was measured at above detection, and therefore elevated compared to background below the Red & Bonita Mine (SE-9). Antimony and zinc become elevated at the locations immediately below the confluence with Dry Gulch (SE-25) and below the confluence with Prospect Gulch (SE-26). Copper is elevated in Cement Creek below the confluence with Dry Gulch (SE-25). Elevated metals concentrations for sediment samples occurred at a lower frequency than that of aqueous samples,

All surface water and sediment samples analyzed for cyanide were found to be non-detect. Surface water samples analyzed for organics were found to be non-detect, except that Methylene chloride was found at low levels (2ug/L) in two surface water samples (CC-SW-24, Cement Creek below the confluence with South Fork and PG-SW-03, Prospect Gulch below the Galena Queen Mine) and three of the rinsate samples; one surface water sample contained a low concentration of acetone (CC-SW-24 @ 3ug/L). Three sediment samples were also found to contain low concentrations of methylene chloride (CC-SE-06, Cement Creek below the Mogul Mines @ 4ug/kg; CC-SE-12, the North Fork of Cement Creek below the Gold King Mine @ 4ug/kg; and CC-SE-24, Cement Creek below the confluence with South Fork @10ug/kg) ; one sediment sample was found to contain low concentrations of acetone (CC-SE-24 @ 7 ug/kg). Organic compound analytical results are presented in Table 3. Methylene chloride and acetone are common laboratory contaminants.

The risk posed to human health or the environment by the on-site and air pathways for the sources identified is considered to be minimal. There are no persons living on-site or within 200 feet of any

of the identified sources. Although the sources located along Cement Creek, Prospect Gulch and their tributaries are uncovered and access is not restricted, these sources are located more than 1-mile from the nearest residents.

Three ground water wells and two surface water sources used for drinking water were sampled. Total lead concentrations in the Cement Creek Well (GW-1), and both total and dissolved lead concentrations in the Lenore Load adit (GW-4) and the Mineral Creek Well (GW-5) exceed the EPA recommended action level of 15 ug/l. The Lenore lode adit (GW-4) total and dissolved cadmium concentrations exceed EPA's recommended action level of 5ug/L. Except for the Lenore lode adit, the remaining drinking water samples had manganese concentrations ranging between 352 to 2130 ug/L; well above the current EPA Action Level of 200 ug/l. The groundwater well above Howardsville (GW-3) was the only site with manganese concentrations above the CDPHE health based advisory of 800 ug/l.

Letters have been sent to each of the drinking water users providing them with the analytical results. Retesting of each well/surface water was offered to each household, such that samples could be taken to determine the effectiveness of any in-home filtration system to remove cadmium, lead or manganese. In those instances where the lead and cadmium concentrations exceeded drinking water standards or action levels, the users were advised not to consume the water without adequate filtration.

CDPHE update 10/21/98: DW resources tested no longer in use or in very limited (a few weeks per year) use. Documentation added to Appendix E.
PBS

6.0 REFERENCES

Colorado Department of Health, Hazardous Materials and Waste Management Division, 1988. *Standard Operating Procedures for Sampling of Hazardous Waste Sites.*

Colorado Department of Health, Hazardous Materials and Waste Management Division, 1994a. *Preliminary Assessment for the Kendrick & Gelder Smelting Company*. March.

CDH - Colorado Department of Health, Water Quality Control Division, 1994b. *Exhibit 3 - Upper Animas Water Quality Classification and Standards Proposal.* July.

CDPHE - Colorado Department of Public Health and Environment, Water Quality Control Division, 1994. *Memorandum Regarding Draft Report, Animas River Loading Analysis.* December 30.

Colorado Department of Public Health and Environment, Hazardous Materiaand Wasteste Management Division, 1995a. *Site Inspection Combined Sampling and Analysis Plan, West Willow Creek and East Willow Creek Sites, Creede Mining District Mineral County, Colorado*. May.

CDPHE, Hazardous Materials and Waste Management Division, 1995b. *DRAFT Animas Discovery Report Upper Animas River Basin*. October.

Colorado Department of Public Health and Environment, Hazardous Materials and Waste Management Division. *Sample and Analysis Plan: Cement Creek Watershed.* July, 1996.

Colorado Division of Water Resources, 1996. *Groundwater Well Permit Data Base*, February 29.

DMG - Colorado Division of Minerals and Geology, 1995a. *Reconnaissance Feasibility Investigation Report. Upper Animas River Basin.* March.

DMG, 1995b. *Animas River Targeting Continuation Project.* Fiscal Year 1996.

DMG, Inactive Mine Program, 1996. Telephone conversations and personal meetings with Jim Herron. July, August, September.

DMG, 1997. *Animas River Targeting Continuation Project, Upper Animas Watershed Sampling and Analysis Plan.* Fiscal Year 1997.

District Court, City and County of Denver, State of Colorado, 1996. *DRAFT Consent Decree and Order. Case No. 94 CV 5459. Sunnyside Gold Corporation, Plaintiff v. Colorado Water Quality Control Division of the Colorado Department of Public Health and Environment, Defendant.*

Harte, Holdron, Schneider, and Shirley, 1991. *Toxics A to Z A Guide to Everyday Pollution Hazards.* University of California Press, Los Angeles, California.

U.S. Environmental Protection Agency, 1990. *The Samplers Guide to the Contract Lab Program.*

USFWS - U. S. Fish and Wildlife Service, 1995. *Letter to the Colorado Department of Natural Resources, Division of Minerals and Geology in partial fulfillment of NEPA.* Received April.

U.S. Geological Survey, 1995. *Naturally Occurring and Mining Affected Dissolved Metals in Two Subbasins of the Upper Animas River Basin, Southwestern Colorado.* Fact Sheet S-243-95. December.

TABLES

DATA VALIDATION AND INTERPRETATION

The laboratory acquired data were validated by the EPA Environmental Services Assistance Team (ESAT). The following data qualifiers were assigned:

- "U" - The analyte was not detected. (Qualified by laboratory software).
- "J" - The assigned value is an estimate because the quality control criteria were not met.
- "UJ" - The analyte was not detected and the reported value is estimated because the quality control criteria were not met.
- "B" "BD" - The analyte was detected at a level below the contract required detection limit (CRDL) but above the method detection limit (MDL), therefore the associated value is an estimate. The presence of the compound is reliable.
- "BJ" - The value is estimated because the analyte was detected at a concentration below the CRDL and because the quality control criteria were not met.
- "R" - The data are rejected.
- "NA" - Indicates that the anlayte was not sampled/analyzed for.

Analytes present at "elevated" concentrations are highlighted in the summary tables. A concentration is considered to be "elevated" if the following are true:

- The concentration of a particular analyte in a sample is three times greater than the background concentration; and greater than or equal to five times any blank sample concentrations.
- If the analyte is not detected in the background sample, the concentration is greater than the sample quantitation limit for both the sample and the background sample.

TABLE 1

CEMENT CREEK SOLID SOURCE SAMPLES
TOTAL METALS
Concentrations in milligrams per kilogram (mg/kg)

	UPPER CEMENT CREEK				MINNEHAHA	MID FORK	LOWER CEMENT CREEK	
Location	CC-SO-2	CC-SO-4	CC-S0-6	CC-SO-9	CC-SO-10	CC-SO-11	CC-SO-15	CC-SO-25
Analyte	Queen Anne Mine Waste Rock Pile	Ross Basin Unnamed Mine Waste Rock Pile	Mogul Mine Waste Rock Pile	Red & Bonita Mine Waste Pile	Lead Carbonate Mine Waste Pile	Middle Fork Unnamed Mine Waste Rock Pile	Gold Hub Mine Waste Rock Pile	Anglo Saxon Mine Waste Rock Pile
Aluminum	1410	1450	850	819	820	611	1530	1230
Antimony	5.8 B	48.8	41.3	0.61 U	8 B	9.6 B	1.5 B	3.2 B
Arsenic	132 J	97.1 J	23.7 J	3 J	13.5 J	10 J	9.1 J	20.7 J
Barium	527	73.4	102	138	21.7 B	19.1 B	23.1 B	149
Berylium	0.46 B	0.43 B	0.23 B	0.21 B	0.21 U	0.21 U	0.21 U	0.25 B
Cadmium	2.9	35.6	176	0.2 U	1.5	2.8	0.87 B	0.39 B
Calcium (D)	577 B	242 B	127 B	126 B	190 B	175 B	229 B	1660
Chromium	0.3 B	0.66 B	0.42 B	0.25 B	0.21 U	0.21 U	0.38 B	1.3 B
Cobalt	0.67 B	3.5 BJ	0.21 U	0.2 U	0.75 B	0.41 B	6.4 B	1.4 B
Copper	117	3470	1050	7.1	119	456	336	63.7
Iron	26800	46900	18400	2370	72210	21600	29900	8930
Lead	3100	15700	24400	961	4650	36000	633	168
Magnesium	143 B	100 B	24.9 B	34 B	36.4 B	144 B	936 B	1470
Manganese	137 J	104 J	373 J	4.1 J	16 J	134 J	150 J	45.5 J
Mercury	2.3 J	0.85 J	0.64 J	0.32 J	0.11 UR	0.14 J	0.1 UR	0.1 UR
Nickel	0.23 B	0.58 BJ	0.21 U	0.2 U	0.71 B	0.21 U	5.1 B	0.44 B
Potassium	1370	2350	631 B	421 B	646 B	513 B	1510	739 B
Selenium	5.2	4.6	5	1	2	17	4	3.4
Silver	23 B	115	102	1.7 B	17.7	38.2	5.2	1.6 B
Sodium	167 B	209 B	216 B	152 B	220 B	248 B	176 B	201 B
Thallium	1.7 B	2.5	1.4 B	0.41 U	0.43 U	0.43 U	1.6 B	0.74 B
Vanadium	4.6 B	9.2 B	2.2 B	1.5 B	2.4 B	10.7	5.1 B	9.8 B
Zinc	715 J	9240 J	5800 J	25.8 J	393 J	731 J	172 J	31.2 J

TABLE 1

CEMENT CREEK SOLID SOURCE SAMPLES
TOTAL METALS
Concentrations in milligrams per kilogram (mg/kg)

	NORTH FORK	MIDDLE FORK	PROSPECT GULCH				
Location	OP-SO-1	OP-SO-2	PG-S0-1	PG-SO-2	PG-SO-4	PG-SO-5	PG-SO-7
Analyte	Upper Gold King Mine Waste Rock Pile	Silver Ledge Mine Waste Rock Pile	Galena Queen Mine Waste Rock Pile	Hercules Mine Waste Pile	Henrietta (7) Mine Waste Pile	Lark Mine Waste Rock Pile	Joe & John's Mine Waste Rock Pile
Aluminum	1690	4300	1280	524	1360	430	1050
Antimony	15.6	0.62 U	26.8	32	40.5	45.6	41.9
Arsenic	25 J	4.3 J	106 J	154 J	130 J	62.2 J	324 J
Barium	72.3	8.3 B	159	48	260	308	413
Beryllium	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U
Cadmium	1.4	0.21 U	27.7	112	6.1	8.7	5.3
Calcium (D)	446 B	219 B	139 B	81.9 B	546 V	71.8 B	99.5 B
Chromium	1.4 B	2.7	0.44 B	0.38 B	0.21 U	5.4	1.7 B
Cobalt	0.71 B	0.79 B	0.21 U	0.21 U	1.6 B	0.47 B	0.48 B
Copper	252	5.3	220	335	295	99.9	447
Iron	18400	6310	6670	15400	23500	3680	18900
Lead	3380	172	17300	74000	16000	2560	7310
Magnesium	1060	6010	29.8 B	18.1 B	224 B	8.3 B	81.2 B
Manganese	322 J	244 J	10.5 J	22.6 J	42.4 J	0.87 BJ	5.1 J
Mercury	0.47 J	0.2 J	0.67 J	1.6 J	0.3 J	0.81 J	1 J
Nickel	0.21 U	0.9 B	0.21 U	0.21 U	0.29 B	0.56 B	0.21 U
Potassium	1070	431 B	734 B	799 B	1560	435 B	1210
Selenium	3.1	0.98 B	5.4	9.1	6.4	3.4	12.7
Silver	24.8	2.1	39.1	61.7	76.5	18.1	64.8
Sodium	363 B	185 B	170 B	164 B	209 B	154 B	194 B
Thallium	1.7 B	0.91 B	0.85 B	0.95 B	0.98 B	0.43 U	1.1 B
Vanadium	10.6	11.5	2.6 B	2.9 B	5.7 B	1.8 B	9 B
Zinc	366 J	33.8 J	7560 J	22300 J	1550 J	2070 J	1580 J

TABLE 2

CEMENT CREEK AQUEOUS SOURCE SAMPLES
TOTAL METALS, DISSOLVED NUTRIENTS PLUS CYANIDE
Concentrations in micrograms per liter (ug/L)

	UPPER CEMENT CREEK			MIDDLE FORK	S. FORK CEMENT CR		
Location	SO-1	CC-SO-3	SO-5	S0-12	SO-13	SO-17	S0-24
Analyte	SOURCE SAMPLE QUEEN ANNE MINE	SOURCE SAMPLE ROSS BASIN UNNAMED MINE	SOURCE SAMPLE MOGUL MINE DRAINAGE	SOURCE SAMPLE BLACK HAWK MINE DRAINAGE	SOURCE SILVER LEDGE MINE	SOURCE BIG COLORADO MINE	SOURCE SAMPLE DRY GULCH ADIT DRAINAGE
Flow (cfs)	0.05	0.02	0.02	0.2	0.89	0.04	0
pH	6.37	3.43	2.89	7.29	6.28	4.56	3.36
Conductivity	301	510	1098	1200	1050	825	469
Hardness	113	85.1	226	694	578	337	55.5
Aluminum	614	10085	5243	106	1014	7346	10960
Antimony	BD	BD	BD	BD	BD	BD	BD
Arsenic	BD	BD	17.3	BD	2.1	8.7	BD
Barium	15.3	22.7	8.8	9.4	10.2	2.4	1.9
Beryllium	BD	BD	4.7	BD	1.6	1.8	1
Cadmium	10.9	86.7	148	2.5	2.4	6.7	9.5
Calcium (D)	40.6	21.09	83.53	259.2	216.8	319.3	4.9
Chromium	BD	BD	BD	BD	4.7	BD	BD
Cobalt	8.5	13.8	27.3	5	17	63	26.8
Copper	231.6	2613.4	6422.8	11.2	15.7	25.9	57.4
Iron	1816.6	824.3	51192	2206.1	15638	78415	18266
Lead	81.6	39.4	206.22	5.9	5.2	1.7	1.8
Magnesium (D)	2.8	7.87	4.2	11.35	8.98	13.01	10.5
Manganese	1190.8	7284.7	9742.7	2742.3	2405.2	2323.3	848.7
Mercury	NA	NA	NA	NA	NA	NA	NA
Nickel	BD	13.1	15.1	BD	BD	40.1	13.8
Potassium (D)	BD	BD	1	1.1	BD	2.8	BD
Selenium	BD	BD	BD	BD	BD	BD	BD
Silver	NA	NA	NA	NA	NA	NA	NA
Sodium (D)	0.98	0.96	3.32	3.32	3.71	3.93	2.32
Thallium	BD	BD	BD	BD	BD	BD	BD
Vanadium	BD	BD	BD	BD	3.2	BD	BD
Zinc	2027.8	16485	28091	717.9	704.8	2780.5	802.2
Cyanide	NA	NA	NA	NA	NA	NA	NA

1800733

TABLE 2

CEMENT CREEK AQUEOUS SOURCE SAMPLES
TOTAL METALS, DISSOLVED NUTRIENTS PLUS CYANIDE
Concentrations in micrograms per liter (ug/L)

						PROSPECT G.
Location	SO-18	SO-20	SO-19	S0-16	SO-23	PG-SO-6
Analyte	SOURCE PROSPECT G. ADIT	SOURCE KANSAS CITY MINE	SOURCE GEORGIA GULCH ADIT	SOURCE ANGLO SAXON MINE	SOURCE PORCUPINE G. ADIT	Joe & John's Mine Drainage
Flow (cfs)	0.07	0	0.38	0.09	0.09	9.49
pH	4.9	3.02	7.05	6.61	6.58	3.86
Conductivity	1464	1431	1501	1692	1526	772
Hardness	590	352	855	880	795	450
Aluminum	1758	9976	BD	356	442	13352
Antimony	BD	BD	BD	8.4	BD	BD
Arsenic	12.1	54.2	3.1	BD	5.2	7.5
Barium	4.8	2.4	9.7	12.1	12.6	9.8
Berylium	1.7	2.5	BD	2.2	1.4	BD
Cadmium	1.8	35.4	BD	3.6	2.4	2.3
Calcium (D)	207	119.7	331.8	319.3	291.1	165.6
Chromium	BD	BD	BD	BD	BD	BD
Cobalt	32.1	BD	BD	42.2	36.2	17.3
Copper	44.2	2137.3	BD	14.3	29.3	14.4
Iron	53721	61240	3701.9	39290	23829	18827
Lead	0.8	124.61	BD	8.9	4.4	14.7
Magnesium (D)	17.7	12.85	6.43	20.19	16.52	8.75
Manganese	4511.2	32659.1	1687.7	9173.9	11094	1732.6
Mercury	NA	NA	NA	NA	NA	NA
Nickel	22.5	34.8	BD	12.1	BD	13.4
Potassium (D)	2.4	BD	BD	3.5	1.3	3.3
Selenium	BD	BD	BD	BD	BD	BD
Silver	NA	NA	NA	NA	NA	NA
Sodium (D)	5.06	0.99	7.9	9.19	8.82	3.18
Thallium	BD	BD	BD	BD	BD	BD
Vanadium	BD	BD	BD	BD	BD	BD
Zinc	978.6	8254	171.7	2780.5	2085.1	863.5
Cyanide	NA	NA	NA	NA	NA	NA

ED_000552_00029910-00043

TABLE 3

CEMENT CREEK SURFACE WATER AND SEDIMENT SAMPLES
ORGANIC COMPOUNDS ABOVE DETECTION

LOCATION		COMPOUNDS		
		METHYLENE CHLORIDE	ACETONE	TOC
CC-SW-06	Cement Creek Below Mogul Mine			< 1 mg/L
CC-SE-06	Cement Creek Below Mogul Mine	4 ug/kg	BD	
CC-SW-12	North Fork Below Gold King Mine			1 mg/L
CC-SE-12	North Fork Below Gold King Mine	4 ug/kg	BD	
CC-SE-24	Cement Creek Below South Fork	10 ug/kg	7 ug/kg	
CC-SW-24	Cement Creek Below South Fork	2 ug/L	BD	<1 mg/L
CC-SW-31	Cement Creek Below Porcupine Gulch			<1 mg/L
CC-SW-36	Duplicate of CC-SW-06			<1 mg/L
CC-SW-37	Rinsate	2 ug/L	BD	<1 mg/L
CC-SW-40	Rinsate	2 ug/L	BD	
CC-SW-39	Rinsate	2 ug/L	BD	
PG-SW 03	Prospect Gulch Below Galena Queen Mine	3 ug/L	3 ug/L	2 mg/L
PG-SW-15	Prospect Gulch Below Henrietta Mine			<1 mg/L

Note, all other organic compounds measured were below detection limits.

TABLE 4

CEMENT CREEK SURFACE WATER SAMPLES
TOTAL METALS PLUS CYANIDE
Concentrations in micrograms per liter (ug/L)

	UPPER CEMENT CREEK										
Location	CC-SW-1	SO-1	CC-SW-2	CC-SW-3	SO-3	CC-SW-4	CC-SW-5	SO-5	CC-SW-6	CC-SW-7	CC-SW-8
Analyte	BACKGROUND Cement Creek Above Queen Anne	AQ SOURCE	Cement Creek Below Queen Anne	BACKGROUND Ross Basin Trib Above Unnamed Mine	AQ SOURCE	Ross Basin Trib Below Unnamed Mine	Cement Creek Above Mogul and S. Mogul Mines	AQ SOURCE	Cement Creek Below Mogul & S. Mogul Mines	Cement Creek Above Corkscrew G. Above Ferricrete	Cement Creek Below Corkscrew G. Below Ferricrete
Flow (cfs)	0.08		0.11	0.63		0.52	1.42		1.84	1.42	1.45
pH	7.05		5.46	4.47		4.47	4.73		3.83	4.24	5.01
Conductivity	189		394	187		182	210		225	250	359
Hardness	83.3		162	83.3		74.7	86.6		85.2	102	112
Aluminum	40		3224	284		840	818		1241	1114	1108
Antimony	BD		BD	BD		BD	BD		BD	BD	BD
Arsenic	BD		BD	BD		BD	BD		BD	BD	BD
Barium	28.2		31.5	26.9		28.4	29.4		29	27.5	26
Berylium	BD		BD	BD		BD	BD		BD	BD	BD
Cadmium	1.2		11.5	3.3		9.4	7.9		11.1	12.2	10
Chromium	BD		BD	BD		BD	BD		BD	BD	BD
Cobalt	BD		BD	BD		BD	BD		BD	BD	BD
Copper	6.2		116	74.6		223.5	166.4		244	215.1	192.6
Iron	16.7		104	27		118.7	77.1		100.7	113.3	50.9
Lead	BD		2.8	3.6		3.3	4.6		4.8	5.6	6.3
Manganese	1.8		4402.9	120.4		521.4	690.4		884.4	832.3	792.3
Mercury	NA		NA	NA		NA	NA		NA	NA	NA
Nickel	BD		11.9	BD		BD	BD		BD	BD	BD
Selenium	BD		BD	BD		BD	BD		BD	BD	BD
Silver	NA		NA	NA		NA	NA		NA	NA	NA
Thallium	BD		BD	BD		BD	BD		BD	BD	BD
Vanadium	BD		BD	BD		BD	BD		BD	BD	BD
Zinc	215.2		2260	517.3		2136.2	2007.3		2614.5	2397	2372
Cyanide	NA		NA	NA		NA	NA		2.7 U	NA	NA

TABLE 4

CEMENT CREEK SURFACE WATER SAMPLES
TOTAL METALS PLUS CYANIDE
Concentrations in micrograms per liter (ug/L)

	CEMENT CREEK		NORTH FORK OF CEMENT CREEK		MINNEHAHA CREEK		MIDDLE FORK OF CEMENT CR.		
Location	CC-SW-9	CC-SW-13	CC-SW-10	CC-SW-12	CC-SW-15	CC-SW-16	SO-12	CC-SW-19	CC-SW-20
Analyte	Cement Creek Below Red & Bonita Mine	Cement Creek Below Confluence with North Fork	BACKGROUND North Fork Above Gold King Mine	North Fork Below Gold King Mine	Minnehaha Creek Below Lead-Carbonate Mill	Minnehaha Creek Above Confluence With South Fork	AQ SOURCE	Middle Fork Below Black Hawk Mine	Middle Fork Above confluence With South Fork
Flow (cfs)	1.79	1.15	NA	0.2	0.05	0.16		0.62	0.44
pH	4.32	4.54	NA	2.68	4.24	6.46		6.68	6.87
Conductivity	361	376	NA	2090	190	143		646	580
Hardness	114	117	NA	262	57.8	61.7		330	304
Aluminum	1524	1849	1050	62206	3185	46		212	291
Antimony	BD	BD	3	BD	BD	BD		BD	BD
Arsenic	BD	BD	3	5.2	BD	BD		BD	BD
Barium	26.3	25.8	66.3	2.5	25.2	12.9		13	13
Beryllium	BD	BD	1	5.8	BD	BD		BD	BD
Cadmium	11.1	13.5	1.5	112	11.6	0.5		1.5	1
Chromium	BD	BD	1	18	BD	BD		BD	BD
Cobalt	BD	BD	12.4	116	BD	6.8		BD	BD
Copper	196.8	217.6	5.2	6292	268.4	6.3		13.7	12.9
Iron	146.8	218.2	1440	88912	3877	67		789.8	720.6
Lead	6.4	7.3	3.6	3.5	170.7	1.8		2.4	1.7
Manganese	812.6	861.9	2180	11208	728.3	3.3		808.1	399.5
Mercury	NA	NA	0.2	NA	NA	NA		NA	NA
Nickel	BD	BD	17.9	80.7	BD	BD		BD	BD
Selenium	BD	BD	4	BD	BD	BD		BD	BD
Silver	NA	NA	1	NA	NA	NA		NA	NA
Thallium	BD	BD	6.8	BD	BD	BD		BD	BD
Vanadium	BD	BD	1	BD	BD	BD		BD	BD
Zinc	2618.8	2700.3	212	21932	2557.5	93		368.7	236
Cyanide	NA	NA	NA	5.4 U	NA	NA		NA	NA

TABLE 4

CEMENT CREEK SURFACE WATER SAMPLES
TOTAL METALS PLUS CYANIDE
Concentrations in micrograms per liter (ug/L)

	SOUTH FORK OF CEMENT CREEK					CEMENT CREEK				
Location	**CC-SW-21**	**S0-13**	**SO-17**	**CC-SW-22**	**CC-SW-23**	**CC-SW-33**	**CC-SW-24**	**SO-24**	**CC-SW-25**	**CC-SW-26**
Analyte	BACKGROUND S. Fork Above Silver Ledge Mine	AQ SOURCE	AQ SOURCE	South Fork Below Silver Ledge Mine	South Fork Above Confluence with Cement Cr.	Cement Creek Above Confluence With South Fork	Cement Creek Below Confluence With South Fork	AQ SOURCE	Cement Creek Below Confluence With Dry Gulch Adit	Cement Creek Below Confluence With Prospect G.
Flow (cfs)	0.38			1.36	2.27	2.88	4.36		6.5	7.09
pH	6.32			5.71	5.6	7.9	6.11		5.44	4.79
Conductivity	180			658	738	1567	1227		1071	1119
Hardness	82			337	294	694	500		444	406
Aluminum	492			2153	1957	861	1445		2148	3746
Antimony	BD			BD	BD	BD	BD		BD	BD
Arsenic	BD			BD	BD	BD	BD		BD	1.6
Barium	10.2			9.9	11.1	12.8	11.9		10.8	10
Beryllium	BD			BD	BD	BD	BD		BD	BD
Cadmium	BD			2.2	2.6	2.8	2.8		2.6	2.6
Chromium	BD			BD	BD	BD	BD		BD	4.3
Cobalt	BD			16	13.3	BD	5.8		7.7	14.3
Copper	6.5			27.1	29.9	23.9	25.2		19.7	28.9
Iron	120.9			6637.3	3216.9	531.6	2021.4		4023.5	8559.9
Lead	BD			2.6	2.3	11.9	8.4		14.5	13.3
Manganese	59			1276.1	1659.7	2050.8	1671.6		1645.9	1456.9
Mercury	NA			NA	NA	NA	NA		NA	NA
Nickel	BD			BD	BD	BD	BD		BD	BD
Selenium	BD			BD	BD	BD	BD		BD	BD
Silver	NA			NA	NA	NA	NA		NA	NA
Thallium	BD			BD	BD	BD	BD		BD	BD
Vanadium	BD			3	BD	BD	BD		BD	BD
Zinc	41			451.8	707.1	724.9	659.1		706.3	678.7
Cyanide	NA			NA	NA	NA	2.2 U		NA	NA

TABLE 4

CEMENT CREEK SURFACE WATER SAMPLES
TOTAL METALS PLUS CYANIDE
Concentrations in micrograms per liter (ug/L)

Location Analyte	CC-SW-26 Cement Creek Below Confluence With Prospect G.	SO-18 AQ SOURCE	SO-20 AQ SOURCE	CC-SW-28 Cement Creek Below Confluence With Georgia Gulch	SO-19 AQ SOURCE	CC-SW-29 Cement Creek Above Confluence With Porcupine G.	SO-16 AQ SOURCE	SO-23 AQ SOURCE	CC-SW-30 Porcupine G. Above Confluence With Cement Creek	SO-23 AQ SOURCE	CC-SW-31 Cement Creek Below Confluence With Porcupine G.	CC-SW-CC48 Cement Creek Above Confluence With Animas River
Flow (cfs)	7.09			9.49		13.72			0.14		11.89	17.64
pH	4.79			3.86		3.71			4.45		3.76	4.1
Conductivity	1119			772		805			197.00		820	790
Hardness	406			450		452			90.10		442	439
Aluminum	3746			6319		5882			2114.00		5538	5183
Antimony	BD			BD		BD			BD		BD	BD
Arsenic	1.6			7.5		4.5			BD		4.6	2.1
Barium	10			9.8		10.6			27		9.9	12.4
Beryllium	BD			BD		BD			BD		BD	BD
Cadmium	2.6			2.3		2.5			2.5		2.1	2.1
Chromium	4.3			BD		BD			BD		BD	BD
Cobalt	14.3			17.3		17.2			9.9		11.8	13.1
Copper	28.9			14.4		24.4			46.8		26	26.3
Iron	8559.9			18827		13694			457.8		12569	7992.6
Lead	13.3			14.7		17.1			4.6		15.7	12.4
Manganese	1458.9			1732.6		1756.2			869.9		1537.5	1558.9
Mercury	NA			NA		NA			NA		NA	NA
Nickel	BD			13.4		BD			BD		BD	BD
Selenium	BD			BD		BD			BD		BD	BD
Silver	NA			NA		NA			NA		NA	NA
Thallium	BD			BD		BD			BD		BD	BD
Vanadium	BD			BD		5.1			BD		BD	BD
Zinc	678.7			863.5		881.6			590.1		764.8	677.4
Cyanide	NA			NA		NA			NA		NA	NA

TABLE 4

CEMENT CREEK SURFACE WATER SAMPLES
TOTAL METALS PLUS CYANIDE
Concentrations in micrograms per liter (ug/L)

PROSPECT GULCH											
Location Analyte	PG-SW-1 Prospect Gulch Above the Galena Queen Mine	PG-SW-2 Prospect Gulch Above the Galena Queen Mine	S0-1 AQ SOURCE	PG-SW-3 Prospect Gulch Below the Galena Queen Mine	PG-SW-4 Tributary to Prospect Gulch	PG-SW-5 Tributary With Acid Drainage	PG-SW-6 Tributary With Hercules Mine Waste	PG-SW-7 Tributary With Acid Drainage	PG-SW-8 Prospect Gulch Below Tributaries With Acid Drainage	PG-SW-9 Prospect G. Below Mineralized Canyon Above Hemietta Mine	PG-SW-10 Mineralized Trib Above Henrietta Mine Complex
Flow (cfs)	0	0.01		0	0.00	0.01	0	0	0.02	0.05	0.01
pH	4.48	4.46		2.73	5.46	6	3.62	3.67	3.95	3.61	3.66
Conductivity	112	194		1073	585	490	256	575	772.00	414	363
Hardness	37.3	72.1		49	256	199	44.8	201	138.00	135	90.3
Aluminum	40	638		6955	482	93	1861	3379	1279.00	1920	8028
Antimony	BD	BD		BD	BD	BD	BD	BD	BD	BD	BD
Arsenic	BD	BD		2.3	BD	BD	BD	BD	BD	BD	BD
Barium	62.3	42.9		35.6	44.4	43.7	56.8	36.2	42.3	45.9	52.9
Berylium	BD	BD		BD	BD	BD	BD	BD	BD	BD	BD
Cadmium	BD	BD		111	1.5	0.5	4.3	1.5	7.8	7.9	BD
Chromium	BD	BD		BD	BD	BD	BD	BD	BD	BD	BD
Cobalt	6.5	5.9		23.3	7.6	BD	11.9	17.7	9.6	10.5	27.4
Copper	25.5	BD		3116.6	55.2	BD	140.1	130.6	186	171.2	22.8
Iron	18.7	1034.1		18050	324.1	369.4	1056.1	802.1	552.6	919.8	235
Lead	BD	2.5		1027.4	BD	BD	155.9	17	72.77	62.6	41.2
Manganese	28.9	172.3		494.7	149.4	67.6	244.9	939.1	322.5	345.7	1035.6
Mercury	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA
Nickel	BD	BD		12.4	BD	13.4	BD	BD	BD	BD	20.4
Selenium	BD	BD		BD	BD	BD	BD	BD	BD	BD	BD
Silver	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA
Thallium	BD	BD		BD	BD	BD	BD	BD	BD	BD	BD
Vanadium	BD	BD		BD	3.3	BD	BD	BD	BD	BD	BD
Zinc	21.8	44.9		28243	985.1	191.2	797.2	231.3	1720.8	1750.9	171.4
Cyanide	NA	NA		2 U	NA	NA	NA	NA	NA		NA

TABLE 4

CEMENT CREEK SURFACE WATER SAMPLES
TOTAL METALS PLUS CYANIDE
Concentrations in micrograms per liter (ug/L)

	PROSPECT GULCH				UPPER ANIMAS GAUGING STATIONS			
Location	PG-SW-11	PG-SW-16	SO-6	PG-SW-18	CC-SW-CC48	CCM34	CCA68	CCA72
Analyte	Prospect Gulch Below Mineralized Tributaries	Prospect Gulch Below the Henrietta Mine	AQ SOURCE	Prospect Gulch Below Joe & John's Mine	Cement Creek Above Confluence With Animas River	Mineral Creek Above Confluence With Animas R.	Animas River Above Cement Creek	Animas River Below Confluence With Mineral Creek
Flow (cfs)	0.05	0.05		0.04	17.64	51	55	127
pH	3.33	3.08		2.82	4.1	7.7	8.35	7.97
Conductivity	351	741		694	790	313	273	377
Hardness	125	130		122	439	168	125	186
Aluminum	2731	6289		6034	5183	2222	69	1530
Antimony	BD	BD		BD	BD	BD	BD	BD
Arsenic	BD	1.9		BD	2.1	BD	BD	2.1
Barium	40.8	29.8		27.9	12.4	24.2	24.9	22.3
Beryllium	BD	BD		BD	BD	BD	BD	BD
Cadmium	6.3	12.5		12.8	2.1	1.1	1.5	1.5
Chromium	BD	BD		BD	BD	BD	BD	BD
Cobalt	8.6	25.9		25.2	13.1	7.6	BD	BD
Copper	162.7	676.9		616.8	26.3	33.6	BD	18.2
Iron	270	15458		9842	7992.6	3244.2	98.5	2235.8
Lead	63	124.61		103.25	12.4	5.8	1.4	4.3
Manganese	421.8	772.5		751.3	1558.9	298.7	672.3	618.6
Mercury	NA	NA		NA	NA	NA	NA	NA
Nickel	BD	16.3		13.9	BD	BD	BD	BD
Selenium	BD	BD		BD	BD	BD	BD	BD
Silver	NA	NA		NA	NA	NA	NA	NA
Thallium	BD	BD		BD	BD	BD	BD	BD
Vanadium	BD	BD		BD	BD	BD	BD	BD
Zinc	1615.4	2913.3		3020.6	677.4	286.6	431.8	416.1
Cyanide	NA	2 U		NA	NA	NA	NA	NA

TABLE 5

CEMENT CREEK SURFACE WATER SAMPLES
DISSOLVED METALS AND DISSOLVED NUTRIENTS
Concentrations in micrograms per liter (ug/L)

	UPPER CEMENT CREEK										
Location	**CC-SW-1**	**SO-1**	**CC-SW-2**	**CC-SW-3**	**SO-3**	**CC-SW-4**	**CC-SW-5**	**SO-5**	**CC-SW-6**	**CC-SW-7**	**CC-SW-8**
Analyte	BACKGROUND Cement Creek Above Queen Anne	AQ SOURCE	Cement Creek Below Queen Anne	BACKGROUND Ross Basin Trib Above Unnamed Mine	AQ SOURCE	Ross Basin Trib Below Unnamed Mine	Cement Creek Above Mogul and S. Mogul Mines	AQ SOURCE	Cement Creek Below Mogul & S. Mogul Mines	Cement Creek Above Corkscrew G. Above Ferricrete	Cement Creek Below Corkscrew G. Below Ferricrete
Flow (cfs)	0.08		0.11	0.63		0.52	1.42		1.84	1.42	1.45
pH	7.05		5.46	4.47		4.47	4.73		3.83	4.24	5.01
Conductivity	189		394	187		182	210		225	250	359
Hardness	83.3		162	83.3		74.7	86.6		85.2	102	112
Aluminum	BD		3331	BD		451	699		1149	1128	1139
Antimony	BD		BD	BD		BD	BD		BD	BD	BD
Arsenic	BD		BD	BD		BD	BD		BD	BD	BD
Barium	26.8		31	26.2		26.6	28		27.4	23.2	23.4
Berylium	BD		BD	BD		BD	BD		BD	BD	BD
Cadmium	0.8		12.3	2.9		10.3	11.5		11.7	11.1	10.2
Calcium	28.61		53.87	29.33		25.37	29.21		28.8	35.51	39.99
Chromium	BD		BD	BD		BD	BD		BD	BD	BD
Cobalt	BD		BD	BD		BD	BD		BD	BD	BD
Copper	BD		114.2	39.8		220.2	168.6		237.7	202.9	183.4
Iron	BD		BD	BD		5.6	BD		33.9	50.9	29.8
Lead	BD		1.4	BD		2.3	3.8		3.6	5	5.4
Magnesium	2.87		6.79	2.45		2.76	3.32		3.23	3.12	3.06
Manganese	1		4492.8	121.5		517.5	704.8		874.5	806.9	760.8
Mercury	NA		NA	NA		NA	NA		NA	NA	NA
Nickel	BD		14.9	BD		BD	BD		BD	BD	BD
Potassium	BD		BD	BD		BD	BD		BD	BD	BD
Selenium	BD		BD	BD		BD	BD		BD	BD	BD
Silver	NA		NA	NA		NA	NA		NA	NA	NA
Sodium	0.14		1.13	0.85		0.91	0.83		0.9	1.13	1.18
Thallium	BD		BD	BD		BD	BD		BD	BD	BD
Vanadium	BD		BD	BD		BD	BD		BD	BD	BD
Zinc	225		2419	537.3		2248.4	2160.4		2727.7	2447.6	2391.6
Cyanide	NA		NA	NA		NA	NA		NA	NA	NA

TABLE 5

CEMENT CREEK SURFACE WATER SAMPLES
DISSOLVED METALS AND DISSOLVED NUTRIENTS
Concentrations in micrograms per liter (ug/L)

			N FORK OF CEMENT CREEK		MINNEHAHA CREEK		MIDDLE FORK OF CEMENT CREEK		
Location	CC-SW-9	CC-SW-13	CC-SW-10	CC-SW-12	CC-SW-15	CC-SW-16	SO-12	CC-SW-19	CC-SW-20
Analyte	Cement Creek Below Red & Bonita Mine	Cement Creek Below Confluence with North Fork	BACKGROUND North Fork Above Gold King	North Fork Below Gold King Mine	Minnehaha Creek Below Lead-Carbonate Mill	Minnehaha Creek Above Confluence With South Fork	AQ SOURCE	Middle Fork Below Black Hawk Mine	Middle Fork Above confluence With South Fork
Flow (cfs)	1.79	1.15	NA	0.2	0.05	0.16		0.62	0.44
pH	4.32	4.54	NA	2.68	4.24	6.46		6.68	6.87
Conductivity	361	376	NA	2090	190	143		646	580
Hardness	114	117	NA	262	57.8	61.7		330	304
Aluminum	1418	1788	NA	58773	2772	BD		108	BD
Antimony	BD	BD	NA	BD	BD	BD		BD	BD
Arsenic	BD	BD	NA	4.4	BD	BD		BD	BD
Barium	23.3	22.6	NA	1.6	21.6	10.7		12.3	12
Beryllium	BD	BD	NA	5.3	BD	BD		BD	BD
Cadmium	11	11	NA	100	9.6	BD		1.4	0.9
Calcium	40.51	41.13	NA	50.79	19.09	22.01		121.8	112.1
Chromium	BD	9.4	NA	14.2	BD	BD		BD	BD
Cobalt	BD	BD	NA	1.6	9.3	BD		5.7	BD
Copper	182.3	210.1	NA	5959.6	242.6	BD		11.9	BD
Iron	46.7	142.4	NA	80355	857.6	8.5		13.4	50.8
Lead	6.2	6.1	NA	1.7	108.3	BD		1.8	BD
Magnesium	3.07	3.26	NA	32.85	2.45	1.64		6.17	5.94
Manganese	774.1	832.8	NA	10569.5	681.3	1.3		717.2	329.9
Mercury	NA	NA	NA	NA	NA	NA		NA	NA
Nickel	BD	11.8	NA	82.2	BD	BD		BD	BD
Potassium	1.3	BD	NA	BD	BD	BD		BD	BD
Selenium	BD	BD	NA	BD	BD	BD		BD	BD
Silver	NA	NA	NA	NA	NA	NA		NA	NA
Sodium	1.68	1.29	NA	2.95	1.37	0.98		1.82	1.82
Thallium	BD	BD	NA	BD	BD	BD		BD	BD
Vanadium	BD	5.4	NA	BD	BD	BD		4.8	BD
Zinc	2673.2	2545.3	NA	19950	2328.3	75.5		298.2	196.3
Cyanide	NA	NA	NA	NA	NA	NA		NA	NA

TABLE 5

CEMENT CREEK SURFACE WATER SAMPLES
DISSOLVED METALS AND DISSOLVED NUTRIENTS
Concentrations in micrograms per liter (ug/L)

	SOUTH FORK OF CEMENT CREEK					CEMENT CREEK				
Location	**CC-SW-21**	**S0-13**	**SO-17**	**CC-SW-22**	**CC-SW-23**	**CC-SW-33**	**CC-SW-24**	**SO-24**	**CC-SW-25**	**CC-SW-26**
Analyte	BACKGROUND S. Fork Above Silver Ledge Mine	AQ SOURCE	AQ SOURCE	South Fork Below Silver Ledge Mine	South Fork Above Confluence with South Fork	Cement Creek Above Confluence With South Fork	Cement Creek Below Confluence With South Fork	AQ SOURCE	Cement Creek Below Confluence With Dry Gulch Adit	Cement Creek Below Confluence With Prospect G.
Flow (cfs)	0.38			1.36	2.27	2.88	4.36		6.5	7.09
pH	6.32			5.71	5.6	7.9	6.11		5.44	4.79
Conductivity	180			658	738	1567	1227		1071	1119
Hardness	82			337	294	694	500		444	406
Aluminum	95			861	895	369	384		1256	3195
Antimony	BD			BD	BD	BD	BD		BD	BD
Arsenic	BD			BD	BD	BD	BD		BD	BD
Barium	9.6			7.8	9.6	11.7	10.9		10.9	10
Beryllium	BD			BD	BD	BD	BD		BD	BD
Cadmium	BD			1.7	2.2	1.4	2		1.9	2
Calcium	29.94			124.9	108.1	264	188.1		165.9	150.3
Chromium	BD			BD	8.1	BD	BD		BD	BD
Cobalt	BD			BD	16.8	BD	7.1		9.7	BD
Copper	7.4			11.5	28.5	BD	9.1		14.3	10
Iron	25.3			5207	2008	39.4	868.1		2831.7	7100.7
Lead	BD			BD	BD	BD	BD		1.3	6.7
Magnesium	1.75			6.12	5.89	8.49	7.4		7.33	7.52
Manganese	58.8			1310.5	1645.4	1390.9	1641.3		1597.3	1460.6
Mercury	NA			NA	NA	NA	NA		NA	NA
Nickel	BD			BD	BD	BD	BD		BD	BD
Potassium	BD			BD	1.4	BD	1.9		BD	BD
Selenium	BD			BD	BD	BD	BD		BD	BD
Silver	NA			NA	NA	NA	NA		NA	NA
Sodium	1.24			2.92	2.5	3.59	3.13		3.13	3.09
Thallium	BD			BD	BD	BD	BD		BD	BD
Vanadium	BD			BD	3.6	BD	BD		BD	BD
Zinc	47.4			441	690.9	317.8	611.1		645.8	701.9
Cyanide	NA			NA	NA	NA	NA		NA	NA

TABLE 5

CEMENT CREEK SURFACE WATER SAMPLES
DISSOLVED METALS AND DISSOLVED NUTRIENTS
Concentrations in micrograms per liter (ug/L)

Location	CC-SW-26	SO-18	SO-20	CC-SW-28	SO-19	CC-SW-29	SO-16	SO-23	CC-SW-30	CC-SW-31	CC-SW-CC48
Analyte	Cement Creek Below Confluence With Prospect G.	AQ SOURCE	AQ SOURCE	Cement Creek Below Confluence With Georgia Gulch	AQ SOURCE	Cement Creek Above Confluence With Porcupine G.	AQ SOURCE	AQ SOURCE	Porcupine G. Above Confluence With Cement Creek	Cement Creek Below Confluence With Porcupine G.	Cement Creek Above Confluence With Animas River
Flow (cfs)	7.09			9.49		13.72			0.14	11.89	17.64
pH	4.79			3.86		3.71			4.45	3.76	4.1
Conductivity	1119			772		805			197.00	820	790
Hardness	406			450		452			90.10	442	439
Aluminum	3195			6042		5812			1673.00	5648	5001
Antimony	BD			46.9		BD			BD	BD	BD
Arsenic	BD			3.2		1.1			BD	4.6	BD
Barium	10			9.5		9.6			24.6	17.9	10.6
Berylium	BD			1.3		BD			BD	1.9	BD
Cadmium	2			1.7		1.9			1.9	1.9	1.8
Calcium	150.3			165.6		167			27.67	163.1	162.6
Chromium	BD			BD		BD			BD	BD	BD
Cobalt	BD			26		13			8	7.9	16.3
Copper	10			34.1		28.8			43.7	16.9	30.6
Iron	7100.7			16868		11624			92.1	10742	5304.7
Lead	6.7			10.5		13.5			1.7	13.1	10.3
Magnesium	7.52			8.75		8.58			5.1	8.35	8.04
Manganese	1460.6			1723		1771.1			856.6	1592.3	1543.5
Mercury	NA			NA		NA			NA	NA	NA
Nickel	BD			19.9		12.5			BD	16.4	16.5
Potassium	BD			3.3		2.9			BD	BD	2.9
Selenium	BD			BD		BD			BD	BD	BD
Silver	NA			NA		NA			NA	NA	NA
Sodium	3.09			3.18		3.38			1.69	3.39	3.71
Thallium	BD			BD		BD			BD	BD	BD
Vanadium	BD			BD		5.1			3.1	BD	BD
Zinc	701.9			833.9		834.3			565.7	775.5	653.5
Cyanide	NA			NA		NA			NA	NA	NA

TABLE 5

CEMENT CREEK SURFACE WATER SAMPLES
DISSOLVED METALS AND DISSOLVED NUTRIENTS
Concentrations in micrograms per liter (ug/L)

PROSPECT GULCH											
Location	PG-SW-1	PG-SW-2	S0-1	PG-SW-3	PG-SW-4	PS-SW-5	PG-SW-6	PG-SW-7	PG-SW-8	PG-SW-9	PG-SW-10
Analyte	Prospect Gulch Above the Galena Queen Mine	Prospect Gulch Above the Galena Queen Mine	AQ SOURCE	Prospect Gulch Below the Galena Queen Mine	Tributary to Prospect Gulch	Tributary With Acid Drainage	Tributary With Hercules Mine Waste	Tributary With Acid Drainage	Prospect Gulch Below Tributaries With Acid Drainage	Prospect G. Below Mineralized Canyon Above Henrietta Mine	Mineralized Trib Above Henrietta Mine Complex
Flow (cfs)	0	0.01		0	0.00	0.01	0	0	0.02	0.05	0.01
pH	4.48	4.46		2.73	5.46	6	3.62	3.67	3.95	3.61	3.66
Conductivity	112	194		1073	585	490	256	575	772.00	414	363
Hardness									138.00	135	90.3
Aluminum	BD	244		6827	62	98	1903	3268	1265.00	1617	7944
Antimony	BD	BD		BD	BD	BD	BD	BD	BD	BD	BD
Arsenic	BD	BD		1.6	BD	BD	BD	BD	BD	BD	BD
Barium	55.4	37.5		32.7	40.9	40.4	53.7	26.8	38.2	38.8	50
Berylium	BD	BD		BD	BD	BD	BD	BD	BD	BD	BD
Cadmium	BD	BD		114	1.4	BD	4.2	1.2	6.9	7.2	BD
Calcium	11.79	23.63		13.06	88.86	69.36	13.97	62.5	46.37	45.25	24.93
Chromium	BD	BD		BD	BD	BD	BD	BD	BD	BD	BD
Cobalt	BD	BD		14.6	BD	BD	BD	9.4	BD	BD	18.8
Copper	18.7	BD		3087.8	BD	BD	139.5	125	180	178.6	21.2
Iron	19.7	209		17864	BD	298.3	955.6	633.9	465.9	250.5	193.3
Lead	BD	0.9		1011.5	BD	BD	167.1	16.1	88.6	57.9	41.5
Magnesium	1.91	3.19		3.98	8.26	6.23	2.41	10.85	5.4	5.33	6.82
Manganese	24.3	164		483.1	137.6	64.6	246.9	901.2	309.5	353.1	1015.4
Mercury	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA
Nickel	BD	BD		18.3	BD	13.4	BD	10.1	BD	11.5	17.5
Potassium	BD	BD		BD	BD	BD	BD	BD	BD	BD	BD
Selenium	BD	BD		BD	BD	BD	BD	BD	BD	BD	BD
Silver	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA
Sodium	0.93	1.04		1.15	1.48	1.26	0.76	0.58	1.02	1.03	0.39
Thallium	BD	BD		BD	BD	BD	BD	BD	BD	BD	BD
Vanadium	BD	BD		BD	BD	BD	BD	BD	BD	BD	BD
Zinc	28.3	35.6		29211	542.4	195.8	841.6	239.3	1741.2	1909.7	187.8
Cyanide	NA	NA		NA	NA	NA	NA	NA	NA		NA

TABLE 5

CEMENT CREEK SURFACE WATER SAMPLES
DISSOLVED METALS AND DISSOLVED NUTRIENTS
Concentrations in micrograms per liter (ug/L)

	PROSPECT GULCH				UPPER ANIMAS GAUGING STATIONS			
Location	PG-SW-11	PG-SW-16	SO-6	PG-SW-18	CC-SW-CC48	CCM34	CCA68	CCA72
Analyte	Prospect Gulch Below Mineralized Tributaries	Prospect Gulch Below the Henrietta Mine	AQ SOURCE	Prospect Gulch Below Joe & John's Mine	Cement Creek Above Confluence With Animas River	Mineral Creek Above Confluence With Animas R.	Animas River Above Cement Creek	Animas River Below Confluence With Mineral Creek
Flow (cfs)	0.05	0.05		0.04	17.64	51	55	127
pH	3.33	3.08		2.82	4.1	7.7	8.35	7.97
Conductivity	351	741		694	790	313	273	377
Hardness	125	130		122	439	168	125	186
Aluminum	2392	6450		6343	5001	BD	BD	BD
Antimony	BD	BD		BD	BD	BD	BD	BD
Arsenic	BD	BD		BD	BD	BD	BD	BD
Barium	37.2	27.5		27.6	10.6	22.8	22.4	20.2
Beryllium	BD	BD		BD	BD	BD	BD	BD
Cadmium	6.5	13.9		14.6	1.8	0.8	1.1	1.2
Calcium	41.19	40.58		37.57	162.6	59.56	45.97	67.65
Chromium	BD	BD		BD	BD	BD	BD	BD
Cobalt	7.3	17		18.7	16.3	7.6	BD	BD
Copper	163.1	689.9		639.8	30.6	7.9	BD	4.2
Iron	247.1	2630.8		10672	5304.7	1979.7	28.6	1156
Lead	61.4	106.9		104.6	10.3	BD	BD	BD
Magnesium	5.3	7.03		6.84	8.04	4.61	2.52	4.05
Manganese	414	783.7		770.2	1543.5	306.6	678	599.6
Mercury	NA	NA		NA	NA	NA	NA	NA
Nickel	12.2	12.8		17.1	16.5	BD	BD	BD
Potassium	BD	BD		BD	2.9	1.3	BD	BD
Selenium	BD	BD		BD	BD	BD	BD	BD
Silver	NA	NA		NA	NA	NA	NA	NA
Sodium	0.94	0.95		0.93	3.71	2.63	1.93	2.53
Thallium	BD	BD		BD	BD	BD	BD	BD
Vanadium	BD	BD		BD	BD	BD	BD	BD
Zinc	1684.9	3125.3		3253.6	653.5	268.8	422.7	376
Cyanide	NA	NA		NA	NA	NA	NA	NA

TABLE 6

CEMENT CREEK SURFACE WATER AND AQUEOUS SOURCE SAMPLES
TOTAL METALS LOADING
Reported in Grams per Day

	UPPER CEMENT CREEK										
Location	CC-SW-1	SO-1	CC-SW-2	CC-SW-3	SO-3	CC-SW-4	CC-SW-5	SO-5	CC-SW-6	CC-SW-7	CC-SW-8
Analyte	BACKGROUND Cement Creek Above Queen Anne	AQ SOURCE Q. ANNE	Cement Creek Below Queen Anne	BACKGROUND Ross Basin Trib Above Unnamed Mine	AQ SOURCE IO NAMI	Ross Basin Trib Below Unnamed Mine	Cement Creek Above Mogul and S. Mogul Mines	AQ SOURCE MOGUL	Cement Creek Below Mogul & S. Mogul Mines	Cement Creek Above Corkscrew G. Above Ferricrete	Cement Creek Below Corkscrew G. Below Ferricrete
Flow (cfs)	0.08	0.05	0.11	0.63	0.02	0.52	1.42	0.02	1.84	1.42	1.45
pH	7.05	6.37	5.46	4.47	3.43	4.47	4.73	2.89	3.83	4.24	5.01
Conductivity	189	301	394	187	510	182	210	1098	225	250	359
Hardness	83.3	113	162	83.3	85.1	74.7	86.6	226	85.2	102	112
Aluminum	7.84	0	884.67	439.75	0	1078.39	2937.81	0	5591.39	3878.34	3928.03
Antimony	0	6.88	0	0	2.78	0	0	3.23	0	0	0
Arsenic	0	0	0	0	0	0	0	1.02	0	0	0
Barium	5.53	1.99	8.634	41.65	1.17	36.46	101.99	0.52	130.66	95.74	92.17
Beryllium	0	0	0	0	0	0	0	0.28	0	0	0
Cadmium	0.24	1.42	3.16	5.11	4.46	12.07	27.41	8.7	50.01	42.27	35.45
Chromium	0	0	0	0	0	0	0	0	0	0	0
Cobalt	0	1.1	0	0	0.71	0	0	1.61	0	0	0
Copper	1.22	30.1	31.83	115.51	135	286.93	577.27	378	1099.35	748.86	682.8
Iron	3.27	236	28.54	41.81	42.4	152.39	267.48	3010	453.71	394.45	180.45
Lead	0	10.6	0.77	5.57	1.98	4.24	15.96	12.1	21.63	19.5	22.33
Manganese	0.35	155	1208.16	186.43	375	669.37	2395.14	573	3984.71	2897.61	2808.82
Mercury	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	0	0	3.27	0	0.67	0	0	0.89	0	0	0
Selenium	0	0	0	0	0	0	0	0	0	0	0
Silver	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	0	0	0	0	0	0	0	0	0	0	0
Vanadium	0	0	0	0	0	0	0	0	0	0	0
Zinc	42.18	263	620.14	800.99	848	2742.45	6963.73	1652	11779.8	8345.04	8409.1
Cyanide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

1800733

TABLE 6

CEMENT CREEK SURFACE WATER AND AQUEOUS SOURCE SAMPLES
TOTAL METALS LOADING
Reported In Grams per Day

	CEMENT CREEK			NORTH FORK OF CEMENT CREEK		MINNEHAHA CREEK		MIDDLE FORK OF CEMENT CREEK		
Location	CC-SW-8	CC-SW-9	CC-SW-13	CC-SW-10	CC-SW-12	CC-SW-15	CC-SW-16	SO-12	CC-SW-19	CC-SW-20
Analyte	Cement Creek Below Corkscrew G. Below Ferricrete	Cement Creek Below Red & Bonita Mine	Cement Creek Below Confluence with North Fork	BACKGROUND North Fork Above Gold King Mine	North Fork Below Gold King Mine	Minnehaha Creek Below Lead-Carbonate Mill	Minnehaha Creek Above Confluence With South Fork	AQ SOURCE B. Hawk	Middle Fork Below Black Hawk Mine	Middle Fork Above confluence With South Fork
Flow (cfs)	1.45	1.79	1.15	NA	0.2	0.05	0.16	0.2	0.62	0.44
pH	5.01	4.32	4.54	NA	2.68	4.24	6.46	7.29	6.68	6.87
Conductivity	359	361	376	NA	2090	190	143	1200	646	580
Hardness	112	114	117	NA	262	57.8	61.7	694	330	304
Aluminum	3928.03	6690.97	5218.62	UD	30480.94	390.16	18.03	51.94	322.55	313.7
Antimony	0	0	0	UD	0	0	0	0	0	0
Arsenic	0	0	0	UD	2.55	0	0	0	0	0
Barium	92.17	115.47	72.82	UD	1.23	3.09	5.06	4.61	19.78	14.01
Beryllium	0	0	0	UD	2.84	0	0	0	0	0
Cadmium	35.45	48.73	38.1	UD	54.88	1.42	0.2	1.23	2.28	1.08
Chromium	0	0	0	UD	8.82	0	0	0	0	0
Cobalt	0	0	0	UD	56.84	0	2.67	2.45	0	0
Copper	682.8	864.03	614.15	UD	3083.37	32.88	2.47	5.49	20.84	13.91
Iron	180.45	644.51	615.85	UD	43566.88	474.93	26.26	1081	1201.64	776.81
Lead	22.33	28.1	20.6	UD	1.72	20.91	0.71	2.89	3.65	1.83
Manganese	2808.82	3567.64	2432.63	UD	5492.07	89.22	1.29	1344	1229.48	430.66
Mercury	NA	NA	NA	UD	NA	NA	NA	NA	NA	NA
Nickel	0	0	0	UD	39.54	0	0	0	0	0
Selenium	0	0	0	UD	0	0	0	0	0	0
Silver	NA	NA	NA	UD	NA	NA	NA	NA	NA	NA
Thallium	0	0	0	UD	0	0	0	0	0	0
Vanadium	0	0	0	UD	0	0	0	0	0	0
Zinc	8409.1	11497.58	7621.33	UD	10746.68	313.29	36.46	351.8	560.96	254.41
Cyanide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

ED_000552_00029910-00058

TABLE 6

CEMENT CREEK SURFACE WATER AND AQUEOUS SOURCE SAMPLES
TOTAL METALS LOADING
Reported Ion Grams per Day

	SOUTH FORK OF CEMENT CREEK					CEMENT CREEK					
Location	CC-SW-21	SO-13	SO-17	CC-SW-22	CC-SW-23	CC-SW-13	CC-SW-33	CC-SW-24	SO-24	CC-SW-25	CC-SW-26
Analyte	BACKGROUND S. Fork Above Silver Ledge Mine	AQ SOURCE S. Ledge	AQ SOURCE Big CO	South Fork Below Silver Ledge Mine	South Fork Above Confluence with Cement Creek	Cement Creek Below Confluence with North Fork	Cement Creek Above Confluence With South Fork	Cement Creek Below Confluence With South Fork	AQ SOURCE Dry Gulch	Cement Creek Below Confluence With Dry Gulch Adit	Cement Creek Below Confluence With Prospect G.
Flow (cfs)	0.38	0.89	0.04	1.36	2.27	1.15	2.88	4.36	0.00245	6.5	7.09
pH	6.32	6.28	4.56	5.71	5.6	4.54	7.9	6.11	3.36	5.44	4.79
Conductivity	180	1050	825	658	738	376	1567	1227	469	1071	1119
Hardness	82	578	337	337	294	117	694	500	55.5	444	406
Aluminum	458.05	2211	647.9	7173.8	10883.86	5218.62	6075.22	15435.5	67.13	34206.9	65106.6
Antimony	0	0	0	0	0	0	0	0	0	0	0
Arsenic	0	4.58	0.77	0	0	0	0	0	0	0	27.81
Barium	9.5	22.24	0.21	32.99	61.73	72.82	90.32	127.12	0.01	171.99	173.8
Beryllium	0	3.49	0.16	0	0	0	0	0	0.01	0	0
Cadmium	0	5.23	0.59	7.33	14.46	38.1	19.76	29.91	0.06	41.41	45.19
Chromium	0	10.25	0	0	0	0	0	0	0	0	74.74
Cobalt	0	37.07	5.56	53.31	73.97	0	0	61.96	0.16	122.62	248.54
Copper	6.05	34.23	2.28	90.3	166.29	614.15	168.64	269.19	0.35	313.72	502.29
Iron	112.56	34099	6916	22115.48	17890.79	615.85	3750.97	21592.6	111.88	64074.24	149469
Lead	0	11.34	0.15	8.33	12.79	20.6	83.97	89.73	0.01	230.91	231.16
Manganese	54.93	5255	204.9	4251.97	9230.42	2432.63	14470.4	17856	5.2	26226.88	25356.1
Mercury	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	0	0	3.54	0	0	0	0	0	0.08	0	0
Selenium	0	0	0	0	0	0	0	0	0	0	0
Silver	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	0	0	0	0	0	0	0	0	0	0	0
Vanadium	0	0	0.59	10	0	0	0	0	0	0	0
Zinc	38.17	1537	95.86	1505.4	3932.54	7621.33	5114.89	7040.51	4.91	11247.83	11796
Cyanide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 6

CEMENT CREEK SURFACE WATER AND AQUEOUS SOURCE SAMPLES
TOTAL METALS LOADING
Reported in Grams per Day

CEMENT CREEK											
Location	CC-SW-26	SO-18	SO-20	CC-SW-28	SO-19	CC-SW-29	SO-16	SO-23	CC-SW-30	CC-SW-31	CC-SW-CC48
Analyte	Cement Creek Below Confluence With Prospect G.	AQ SOURCE Pros.G. Adit	AQ SOURCE Kansas C	Cement Creek Below Confluence With Georgia Gulch	AQ SOURCE Below GA G.	Cement Creek Above Confluence With Porcupine G.	AQ SOURCE Anglo Saxon	AQ SOURCE Porcupine	Porcupine G. Above Confluence With Cement Creek	Cement Creek Below Confluence With Porcupine G.	Cement Creek Above Confluence With Animas River
Flow (cfs)	7.09	0.07	0.0006	9.49	0.38	13.72	0.09		0.14	11.89	17.64
pH	4.79	4.9	3.02	3.86	7.05	3.71	6.61		4.45	3.76	4.1
Conductivity	1119	1464	1431	772	1501	805	1692		197.00	820	790
Hardness	406	590	352	450	855	452	880		90.10	442	439
Aluminum	65106.6	310.11	14.66	14687.98	0	197761	80.24		730.28	161378.98	223998.89
Antimony	0	0	0	0	0	0	0		0	0	0
Arsenic	27.81	2.13	0.08	174.31	2.92	151.3	1.89		0	134.05	90.76
Barium	173.8	0.85	0	227.76	9.13	356.39	2.73		9.33	288.49	535.9
Beryllium	0	0.3	0	0	0	0	0.5		0	0	0
Cadmium	45.19	0.32	0.05	53.45	0	84.05	0.81		0.86	61.19	90.76
Chromium	74.74	0	0	0	0	0	0		0	0	0
Cobalt	248.54	5.66	0.08	402.06	0	578.29	9.51		3.42	343.86	566.16
Copper	502.29	7.8	3.14	334.67	0	820.36	3.22		16.17	757.65	1136.63
Iron	149469	9476.38	90.02	437552.66	3482.75	460411	8855.97		158.15	366264.43	345424.19
Lead	231.16	0.14	0.18	341.64	0	574.93	2.01		1.59	457.5	535.9
Manganese	25356.1	795.78	48.01	40266.84	1587.79	59045.8	2067.8		300.51	44803.21	67372.54
Mercury	NA	NA	NA	NA	NA	NA	NA		NA	NA	NA
Nickel	0	3.97	0.05	311.43	0	0	2.73		0	0	0
Selenium	0	0	0	0	0	0	0		0	0	0
Silver	NA	NA	NA	NA	NA	NA	NA		NA	NA	NA
Thallium	0	0	0	0	0	0			0	0	0
Vanadium	0	0	0	0	0	171.47	0		0	0	0
Zinc	11796	172.63	12.13	20068.34	161.54	29640.6	626.72		203.85	22286.5	29275.87
Cyanide	NA	NA	NA	NA	NA	NA	NA		NA	NA	NA

TABLE 6

CEMENT CREEK SURFACE WATER SAMPLES
TOTAL METALS LOADING
Reported in Grams per Day

PROSPECT GULCH											
Location	PG-SW-1	PG-SW-2	SO-1	PG-SW-3	PG-SW-4	PS-SW-5	PG-SW-6	PG-SW-7	PG-SW-8	PG-SW-9	PG-SW-10
Analyte	Prospect Gulch Above the Galena Queen Mine	Prospect Gulch Above the Galena Queen Mine	AQ SOURCE	Prospect Gulch Below the Galena Queen Mine	Tributary to Prospect Gulch	Tributary With Acid Drainage	Tributary With Hercules Mine Waste	Tributary With Acid Drainage	Prospect Gulch Below Tributaries With Acid Drainage	Prospect G. Below Mineralized Canyon Above Henrietta Mine	Mineralized Trib Above Henrietta Mine Complex
Flow (cfs)	0	0.01		0	0.00	0.01	0	0	0.02	0.05	0.01
pH	4.48	4.46		2.73	5.46	6	3.62	3.67	3.95	3.61	3.66
Conductivity	112	194		1073	585	490	256	575	772.00	414	363
Hardness	37.3	72.1		49	256	199	44.8	201	138.00	135	90.3
Aluminum	0.08	7.82		20.45	0.94	1.14	3.65	26.49	75.83	239.9	98.34
Antimony	0	0		0	0	0	0	0	0	0	0
Arsenic	0	0		0.01	0	0	0	0	0	0	0
Barium	0.12	0.53		0.1	0.09	0.54	0.11	0.28	2.51	5.74	0.65
Beryllium	0	0		0	0	0	0	0	0	0	0
Cadmium	0	0		0.33	0	0.01	0.01	0.01	0.46	0.99	0
Chromium	0	0		0	0	0	0	0	0	0	0
Cobalt	0.01	0.07		0.07	0.01	0	0.02	0.14	0.57	1.31	0.34
Copper	0.05	0		9.16	0.11	0	0.27	1.02	11.03	21.39	0.28
Iron	0.04	12.67		53.07	0.64	4.53	2.07	6.29	32.76	114.93	2.88
Lead	0	0.03		3.02	0	0	0.31	0.13	4.31	7.82	0.5
Manganese	0.06	2.11		1.45	0.29	0.83	0.48	7.36	19.12	43.2	12.69
Mercury	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA
Nickel	0	0		0.04	0	0	0	0	0	0	0.25
Selenium	0	0		0	0	0	0	0	0	0	0
Silver	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA
Thallium	0	0		0	BD	0	0	BD	0	0	0
Vanadium	0	0		0	0.01	0	0	BD	0	0	0
Zinc	0.04	0.55		83.03	1.93	2.34	1.56	1.81	102.03	218.77	2.1
Cyanide	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA

1800733

TABLE 6

CEMENT CREEK SURFACE WATER AND AQUEOUS SOURCE SAMPLES
TOTAL METALS LOADING
Reported in Grams per Day

	PROSPECT GULCH				UPPER ANIMAS GAUGING STATIONS			
Location	PG-SW-11	PG-SW-16	SO-6	PG-SW-18	CC-SW-CC48	CC-SW-M34	CC-SW-A68	CC-SW-A72
Analyte	Prospect Gulch Above the Henrietta Mine	Prospect Gulch Below the Henrietta Mine	AQ SOURCE Joe & Johns	Prospect Gulch Below Joe & John's Mine	Cement Creek Above Confluence With Animas River	Mineral Creek Above Confluence With Animas R.	Animas River Above Cement Creek	Animas River Below Confluence With Mineral Creek
Flow (cfs)	0.05	0.05	0.0001	0.04	17.64	51	55	127
pH	3.33	3.08	2.71	2.82	4.1	7.7	8.35	7.97
Conductivity	351	741	1350	694	790	313	273	377
Hardness	125	130	12.5	122	439	168	125	186
Aluminum	261.4	770.4	3.27	606.12	223998.89	277638.9	9297.75	476059.5
Antimony	0	0	0	0	0	0	0	0
Arsenic	0	0.23	0.01	0	90.76	0	0	0
Barium	4.5	3.65	0	2.8	535.9	3023.79	3355.28	6938.65
Berylium	0	0	0	0	0	0	0	0
Cadmium	0.69	1.53	0.01	1.29	90.76	137.45	202.13	466.73
Chromium	0	0	0	0	0	0	0	0
Cobalt	0.95	3.17	0.01	2.53	566.16	949.62	0	0
Copper	17.94	82.92	0.12	61.96	1136.63	4198.32	0	5662.93
Iron	29.77	1893.61	15.13	988.63	345424.19	405362.79	13272.88	695669.17
Lead	6.95	12.05	0.13	10.37	535.9	724.71	188.65	1337.95
Manganese	46.5	94.63	0.07	75.47	67372.54	37322.57	90592.43	192477.39
Mercury	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	0	2	0.01	1.4	0	0	0	0
Selenium	0	0	0	0	0	0	0	0
Silver	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	0	0	0	0	0	0	0	0
Vanadium	0	0	0	0	0	0	0	0
Zinc	178.1	356.88	2.48	303.42	29275.87	35810.67	58185.05	129469.52
Cyanide	NA	NA	NA	NA	NA	NA	NA	NA

ED_000552_00029910-00062

TABLE 7

CEMENT CREEK SEDIMENT SAMPLES
TOTAL METALS PLUS CYANIDE
Concentrations in milligrams per kilogram (mg/kg)
Page 1 of 6

	UPPER CEMENT CREEK							
Location	CC-SE-1	CC-SE-2	CC-SE-3	CC-SE-4	CC-SE-5	CC-SE-6	CC-SE-7	CC-SE-8
Analyte	BACKGROUND Cement Creek Above Queen Anne	Cement Creek Below Queen Anne	BACKGROUND Ross Basin Trib Above Unnamed Mine	Ross Basin Trib Below Unnamed Mine	Cement Creek Above Mogul and S. Mogul Mines	Cement Creek Below Mogul & S. Mogul Mines	Cement Creek Above Corkscrew G. Above Ferricrete	Cement Creek Below Corkscrew G. Below Ferricrete
Aluminum	6420	12400	18000	13800	13300	12100 J	13900	11100
Antimony	0.76 U	0.94 B	0.67 U	1.1 B	2 B	1.6 B	0.65 UJ	1.3 BJ
Arsenic	119 J	37.3	33.5 J	54.1 J	30.6 J	31 J	28.6	25.6
Barium	75.7	84.5	80.3	51.2 B	44.6 B	45 B	54.6	56.1
Beryllium	1.6	1 B	1.6	0.69 B	0.86 B	0.61 B	0.72 B	0.45 B
Cadmium	6.7	1 B	12.4	3.5	3.8	3.1	1.4	0.77 B
Calcium	1690	1750	2230	1680	1490	1540	1990	1420
Chromium	2.9	8	7.5	7.4	7	4.7	8.4	5.8
Cobalt	14.8	14.1	23.6	20.2	14.5	13.3	12	8.6 B
Copper	158	137	1190	446	432	200 J	250	161
Iron	28800	35200	39600	62400	30300	33200	43800	40100
Lead	1610	377	961	747	834	722 J	395	307
Magnesium	2530	7770	10200	8760	8300	8500 J	8710	6820
Manganese	3770	3530	7970 J	4260 J	3810 J	2500 J	2220 J	1570 J
Mercury	0.13 U	0.12 U	0.11 U	0.13 U	0.12 U	0.13 U	0.11 U	0.12 U
Nickel	6.3 B	6 B	12.3	7.9 BJ	6.3 B	5.5 B	5.1 BJ	3.8 B
Potassium	1010 B	1120 B	636 B	867 B	626 B	879 B	734 B	632 B
Selenium	1.3	1.4	2	1.5	1.7	1.6	1.6	1.8
Silver	0.87 B	1.4 B	0.97 B	1.9 B	1.5 B	1.6 B	1 B	1.6 B
Sodium	168 B	190 B	172 B	170 BJ	166 B	214 B	217 B	212 B
Thallium	12.4	11.6	23.1	14.7	12.1	9.2	8.6	6.6
Vanadium	6.4 B	23.4	33.4	40.1	23	22	28.6	24.8
Zinc	795 J	274 J	1880 J	672 J	475 J	749	340 J	308 J
Cyanide	NA	NA	NA	NA	NA	0.13 U	NA	NA

TABLE 7

CEMENT CREEK SEDIMENT SAMPLES
TOTAL METALS PLUS CYANIDE
Concentrations in milligrams per kilogram (mg/kg)

	CEMENT CREEK			N. FORK OF CEMENT CR		MINNEHAHA CREEK		MIDDLE FORK OF CEMENT CREEK			
Location	CC-SE-8	CC-SE-9	CC-SE-13	CC-SE-10	CC-SE-12	CC-SE-15	CC-SE-16	CC-SE-17	CC-SE-18	CC-SE-19	CC-SE-20
Analyte	Cement Creek Below Corkscrew G. Below Ferricrete	Cement Creek Below Red & Bonita Mine	Cement Creek Below Confluence with North Fork	BACKGROUND North Fork Above Gold King Mine	North Fork Below Gold King Mine	Minnehaha Creek Below Lead-Carbonate Mill	Minnehaha Creek Above Confluence With South Fork	BACKGROND Middle F. Above Unnamed Waste	Middle Fork Below Unnamed Waste Rock Pile	Middle Fork Below Black Hawk Mine	Middle Fork Above confluence With South Fork
Aluminum	11100	4140	7890	13300	9660 J	3570	13800	20200	8950	15900	12000
Antimony	1.3 BJ	0.76 UJ	0.7 UJ	0.69 UJ	0.92 B	7.1 BJ	0.72 UJ	0.66 UJ	0.65 UJ	0.79 UJ	0.69 UJ
Arsenic	25.6	4.8	22.4	4.8	65.6 J	13.9	10.6	51.6	8.8	26.6	14.6
Barium	56.1	19.5 B	72.6	63.8	65.2	49.4 B	54.9	90.1	49.6	35.7 B	38.7 B
Beryllium	0.45 B	0.25 U	0.3 B	0.65 B	0.37 B	0.44 U	0.54 B	1.2	0.57 B	1.5	1 B
Cadmium	0.77 B	0.27 B	0.38 B	0.24 B	0.6 B	7.1	2.7	2.9	0.89 B	4	4.1
Calcium	1420	435 B	725 B	3990	1250	536 B	2690	2110	2840	2670	2420
Chromium	5.8	1.8 B	3	5.1	5.6	2.6 B	6.9	8	3.3	4.7	8.3
Cobalt	8.6 B	2.4 B	6 B	10.6 B	7.3 B	4.6 B	16.1	29.5	10.9	19.7	19.4
Copper	161	91.6	83.9	49.9	87 J	181	181	657	165	284	233
Iron	40100	25500	68600	36500	72300	39100	42200	58100	20000	33700	29200
Lead	307	170	291	21.8	713 J	2220	225	666	164	160	138
Magnesium	6820	1990	4350	7120	5870 J	824 B	9580	11800	5760	9860	9100
Manganese	1570 J	559 J	1160 J	663 J	624 J	329 J	1420 J	3660 J	1400 J	3510 J	2640 J
Mercury	0.12 U	0.43	0.12 U	0.12 U	0.12 U	0.22 U	0.12 U	0.11 U	0.11 U	0.13 U	0.11 U
Nickel	3.8 B	0.97 B	3.8 BJ	7.3 B	2.5 BJ	0.5 B	7.4 B	10.6	6 B	10.8	11.4
Potassium	632 B	238 B	615 B	1370	1140 B	605 B	838 B	1380	730 B	622 B	479 B
Selenium	1.8	1 U	3.3	0.92 U	3.8	5.8 U	1.7	2.6	0.9 B	1 U	1.7
Silver	1.6 B	2.1 B	0.84 B	0.23 U	1.6 B	15.3	0.76 B	4	0.92 B	1.1 B	0.39 B
Sodium	212 B	237 B	224 B	326 B	316 B	450 B	285 B	238 B	181 B	190 B	177 B
Thallium	6.6	2.6	6.9	3.2	5.2	2.5 B	5.6	13.1	4.8	12.1	9
Vanadium	24.6	8 B	26.4	26.4	40.9	8.1 B	43.8	46.7	20.8	30.5	34.7
Zinc	308 J	133 J	147 J	106 J	174	1810 J	789 J	569 J	217 J	1090 J	990 J
Cyanide	NA	NA	NA	NA	0.12 U	NA	NA	NA	NA	NA	NA

TABLE 7

CEMENT CREEK SEDIMENT SAMPLES
TOTAL METALS PLUS CYANIDE
Concentrations in milligrams per kilogrram (mg/kg)

	SOUTH FORK			CEMENT CREEK				
Location	**CC-SE-21**	**CC-SE-22**	**CC-SE-23**	**CC-SE-13**	**CC-SE-33**	**CC-SE-24**	**CC-SE-25**	**CC-SE-26**
Analyte	BACKGROUND S. Fork Above Silver Ledge Mine	South Fork Below Silver Ledge Mine	South Fork Above Confluence with Cement Creek	Cement Creek Below Confluence with North Fork	Cement Creek Above Confluence With South Fork	Cement Creek Below Confluence With South Fork	Cement Creek Below Confluence With Dry Gulch Adit	Cement Creek Below Confluence With Prospect G.
Aluminum	5890	5990	6990	7890	5090	7660 J	8470	7170
Antimony	0.66 UJ	0.68 UJ	0.68 UJ	0.7 UJ	0.67 U	0.7 U	0.97 BJ	1.7 BJ
Arsenic	9.1	16.7	8.5	22.4	10.7 J	15.8 J	17.3	29.5
Barium	50.7	75.5	30 B	72.6	23.1 B	22.1 B	36.8 B	68.2
Beryllium	0.51 B	0.65 B	0.51 B	0.3 B	0.22 U	0.28 B	0.27 B	0.28 B
Cadmium	0.22 B	0.23 U	0.23 U	0.38 B	0.35 B	0.36 B	16.6	14.4
Calcium	1030 B	1400	1030 B	725 B	1680	1380	1840	1400
Chromium	2.3	3.4	2.9	3	2.3	8.2	4.6	3.4
Cobalt	8.9 B	3.3 BJ	3.1 B	6 B	4.1 B	6.1 B	4 B	6.1 B
Copper	37	48.9	48.8	83.9	42.9 J	59.3 J	477	105
Iron	31100	46200	30800	68600	21300	44700	41600	58800
Lead	36	69.4	55.6	291	153 J	142 J	1040	505
Magnesium	3020	2750	4470	4350	3120	5150 J	5400	4450
Manganese	478 J	342 J	599 J	1160 J	547 J	563 J	701 J	1420 J
Mercury	0.11 U	0.11 U	0.11 U	0.12 U	0.11 U	0.12 U	0.12 U	0.12 U
Nickel	3.2 B	0.84 BJ	0.95 B	3.8 BJ	2.1 B	2.5 BJ	2.6 B	1.7 BJ
Potassium	887 B	1280	652 B	615 B	484 B	476 B	747 B	863 B
Selenium	1.7	2.8	1.6	3.3	0.89 UJ	2.4	2.1	2.8
Silver	0.23 B	0.35 B	0.23 U	0.84 B	0.5 B	0.75 B	8.5	1.8 B
Sodium	230 B	379 B	181 B	224 B	154 B	191 B	235 B	210 B
Thallium	2.7	2.9 J	3.1	6.9	2.1 B	3.7	3.7	6.8
Vanadium	18.7	20.9	18.8	26.4	12.3	24.4	35.4	26.6
Zinc	79.2 J	55.6 J	78.6 J	147 J	70.3	146	4460 J	2940 J
Cyanide	NA	NA	NA	NA	NA	0.12 U	NA	NA

TABLE 7

CEMENT CREEK SEDIMENT SAMPLES
TOTAL METALS PLUS CYANIDE
Concentrations in milligrams per kilogram (mg/kg)

Location	CC-SE-26	CC-SE-27	CC-SE-28	CC-SE-29	CC-SE-30	CC-SE-31	CC-SE-CC48
Analyte	Cement Creek Below Confluence With Prospect G.	Georgia Gulch Above Confluence With Cement Cr	Cement Creek Below Confluence With Georgia G.	Cement Creek Above Confluence With Porcupine G.	Porcupine Gulch Above Confluence With Cement Creek	Cement Creek Below Confluence With Porcupine G.	Cement Creek Above Confluence With Animas River
Aluminum	7170	10200	7340	11600	5030.00	8010 J	7820
Antimony	1.7 BJ	0.63 UJ	2.6 U	1.7 U	1.6 U	1.3 U	2 U
Arsenic	29.5	29.6	49 J	27.3 J	40.6 J	27.6 J	38.1 J
Barium	68.2	104	51	48.7 B	81	38.8 B	131
Beryllium	0.28 B	0.76 B	0.32 B	0.4 B	0.42 B	0.27 B	0.33 B
Cadmium	14.4	1.7	5.1	0.86 BJ	3.6	1 BJ	1.7 J
Calcium	1400	1540	1290	1810	1310	1270	1350
Chromium	3.4	3.5	4.7	5.4	0.079 B	7.2	6.1
Cobalt	6.1 B	12.2	4.6 BJ	11.4 B	10.8 B	5 B	6.5 B
Copper	105	189	79 J	90 J	60.2 J	94.5 J	58.4 J
Iron	58800	30300	62900	49500	27600	45600	63400
Lead	505	475	384 J	590 J	1040 J	196 J	297 J
Magnesium	4450	6010	4580	7850	2980	5720 J	4520
Manganese	1420 J	1910 J	488 J	1370 J	1920 J	470 J	605 J
Mercury	0.12 U	0.11 U	0.12 U	0.13 U	0.13 U	0.11 U	0.12 U
Nickel	1.7 BJ	6.6 B	1.8 B	4.4 BJ	0.74 B	2.9 BJ	2.2 BJ
Potassium	863 B	806 B	938 B	761 B	665 B	621 B	1090 B
Selenium	2.8	1.6	3.3 J	1.9 J	1.7 J	2.2	2.6 J
Silver	1.8 B	0.9 B	1.1 B	0.89 B	2.8	1.9 B	1.2 B
Sodium	210 B	210 B	221 B	272 B	188 B	194 B	244 B
Thallium	6.8	7	3.7	5.4	6.6	2.9	3.9
Vanadium	26.6	19.4	33	27.6	20.12	29.7	30.9
Zinc	2940 J	395 J	1110	136	904	222	369
Cyanide	NA	NA	NA	NA	NA	0.11 U	NA

TABLE 7

CEMENT CREEK SEDIMENT SAMPLES
TOTAL METALS PLUS CYANIDE
Concentrations in milligrams per kilogram (mg/kg)

PROSPECT GULCH										
Location	PG-SE-1	PG-SE-2	PG-SE-3	PG-SE-4	PS-SE-5	PG-SE-6	PG-SE-7	PG-SE-8	PG-SE-9	PG-SE-10
Analyte	Prospect Gulch Above the Galena Queen Mine	Prospect Gulch Above the Galena Queen Mine	Prospect Gulch Below the Galena Queen Mine	Tributary to Prospect Gulch	Tributary With Acid Drainage	Tributary With Hercules Mine Waste	Tributary With Acid Drainage	Prospect Gulch Below Tributaries With Acid Drainage	Prospect G. Below Mineralized Canyon Above Henrietta Mine	Mineralized Trib Above Henrietta Mine Complex
Aluminum	7040	3630	2030	16400 J	15900	4340	10100	5390.00	3080	2390
Antimony	0.85 U	1.7 U	48.8	0.8 U	0.74 U	9.3 B	5.2 B	2.9 U	2.7 U	2.8 U
Arsenic	52.3 J	59.6 J	600 J	14.8 J	14.3 J	68.9 J	137 J	99.3 J	84.9 J	42.3 J
Barium	83.7	84	62.8	85.2	78.9	52.5	32 B	69.8	22.9 B	62.5
Beryllium	0.43 B	0.39 B	0.25 U	1.4	1.2 B	0.24 U	0.59 B	0.37 B	0.24 U	0.26 U
Cadmium	0.53 B	0.65 BJ	29.2	3.1	2.5	0.34 B	0.44 B	1.6	1.2	0.26 U
Calcium	1780	1090 B	141 B	3880	3760	235 B	1730	837 B	831 B	218 B
Chromium	3	1.9 B	3.7	2.9	2.6	3	5.5 B	2.8	2.3 B	2.3 B
Cobalt	13.3 B	6.2 BJ	1.3 B	26.3	18.2	0.93 B	9.8 J	6.1 B	3.3 B	0.64 B
Copper	74.2 J	48.8 J	1080 J	62.5 J	57.6 J	40.6 J	112	98.4 J	169 J	12.9 J
Iron	41800	79100	33900	34300	39700	42100	38700 J	45500	18800	21300
Lead	68 J	260 J	7230 J	50.4 J	40.8 J	121 J	325	326 J	199 J	191 J
Magnesium	3280	756 B	456 B	5390 J	6500	1460	4750 J	1570	1320	613 B
Manganese	779 J	375 J	98.5 J	3420 J	1400 J	73.2 J	394 U	467 J	147 J	87.6 J
Mercury	0.14 U	0.13 U	0.34	0.13 U	0.12 U	0.12 U	0.12 U	0.13 U	0.12 U	0.13 U
Nickel	4.8 B	0.37 B	0.25 U	12.4	12.3	0.24 U	5.4 B	1.5 B	1.3 B	0.26 U
Potassium	1070 B	838 B	770 B	1340	1240	844 B	1080 B	899 B	414 B	1190 B
Selenium	2.1 J	3.9 J	3.7 J	1.1 U	1 BJ	2.9 J	2.2 J	3.1 J	1.7 J	4.3 J
Silver	0.28 U	0.49 B	10.6	0.27 U	0.25 U	0.24 U	3.3	1.3 B	1.6 B	0.92 B
Sodium	204 B	205 B	18201.9 B	269 B	210 B	164 B	160 B	175 B	129 B	153 B
Thallium	3.5	4.4	6780 B	11.2	5.3	1.9 B	2.4 B	3.2	0.85 B	0.88 B
Vanadium	19.2	21.1	9.1 B	23.5	24.2	16.6	22.3	16	7.2 B	9.8 B
Zinc	90.3	43.6	8254	734	634	20.3	98.1	340	386	15.6
Cyanide	NA	NA	NA	0.14 BJ	NA	NA	NA	NA	NA	NA

TABLE 7

CEMENT CREEK SEDIMENT SAMPLES
TOTAL METALS PLUS CYANIDE
Concentrations in milligrams per kilogram (mg/kg)

	PROSPECT GULCH						UPPER ANIMAS GAUGING STATIONS			
Location	PG-SE-11	PG-SE-14	PG-SE-15	PG-SE-16	PG-SE-18	PG-SE-19	CCSECC48	CCSEM34	CCSEA68	CCSEA72
Analyte	Prospect Gulch Below Mineralized Tributaries	Springs after seeping through Hernlretta Waste	Prospect Gulch Below Henrietta Waste Pile	Prospect Gulch Below the Henrietta Mine Seep	Prospect Gulch Below Joe & John's Mine	Prospect Gulch Above Confluence With Cement Creek	Cement Creek Above Confluence With Animas River	Mineral Creek Above Confluence With Animas R.	Animas River Above Cement Creek	Animas River Below Confluence With Mineral Creek
Aluminum	4350	4230	4790	3770 J	4440	3950	7820	11500	7820	10700
Antimony	1.8 J	4.7 J	3.3 UJ	3.3 U	5.3 B	4.9 B	2 U	0.86 BU	2.6 BU	401 BU
Arsenic	65.1 J	389	48.2	98.1 J	76.9 J	101 J	38.1 J	29.9 J	17.3 J	33.5 J
Barium	41.8 B	201	93.2	99.8	72.5	73.4	131	121	107	151
Beryllium	0.26 U	0.26 U	0.26 U	0.26 U	0.23 U	0.24 U	0.33 B	0.7 B	0.87 B	0.93 B
Cadmium	0.61 B	2.3	5.7	331 B	0.37 B	0.84 B	1.7 J	1.7	10.1	3.6
Calcium	1100 B	235	715	711 B	409 B	397 B	1350	2450	2490	2970
Chromium	1.3 B	2.7	2.3	1.8 B	2.4	2.1 B	6.1	3.3	5.1	7
Cobalt	6 B	1.4 J	4.2	3.1 B	4.2 BJ	1.7 BJ	6.5 B	17.1	11 B	15.5
Copper	59.8 J	73.6	41.1	63.9 J	57.3 J	62.7 J	58.4 J	161 J	263 J	242 J
Iron	36200	93800	34400	40000	44400	68900	63400	40500	21200	46100
Lead	216 J	503	536	333 J	336 J	340 J	297 J	189 J	1580 J	805 J
Magnesium	1850	1360	1880	1460 J	1430	1710	4520	3780	4710	5200
Manganese	284 J	114 J	316 J	206 J	289 J	210 J	605 J	928 J	7410 J	3300 J
Mercury	0.13 U	0.17 U	0.13 U	0.13 U	0.13 U	0.12 U	0.12 U	0.12 U	0.13 U	0.13 U
Nickel	0.87 B	0.26 U	2.2	0.47 B	0.76 BJ	0.24 U	2.2 BJ	4.8 B	5.2 B	5 B
Potassium	774 B	1650	875	752 B	950 B	873 B	1090 B	799 B	1240 B	1110 B
Selenium	2.7 J	3.2 J	1.8	3.9	2.6 J	1.7 J	2.6 J	1.8 J	1 UJ	1.8 J
Silver	6.2	2.7	3.7	1.4 B	1.3 B	1.7 B	1.2 B	0.41 B	6.7	2.3 B
Sodium	160 B	247	234	197 B	189 B	188 B	244 B	216 B	239 B	223 B
Thallium	1.9 B	4.9 J	2.8	2.6	3.1 J	4.1 J	3.9	4	22.5	11.1
Vanadium	12.9 B	30.8	13.7	15.1	14.6	33.7	30.9	20.3	19.9	28.3
Zinc	79.6	450 J	1190 J	56.7	79.6	256	369	528	1830	901
Cyanide	NA	NA	NA	0.13 U	NA	NA	NA	NA	NA	NA

Table 8

Cement Creek Watershed
Drinking Water Sources
Total and Dissolved Metals

Analytes,	GW-1 Cement Cr., 1 mi. below Prospect G.		GW-2 Mid Fork Cement Cr. **Surface water**		GW-3 Animas R., 1 mi. above Howardsville		GW-4 **Draining adit in** Cunningham Gulch		GW-5 Mineral Cr., 1 mi. Above Animas R.		MCL / ACTION LEVEL
ug/l	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	
Aluminum	1420	1030	164 u	23 u	23	23	23	23	660	632	n/a
Antimony	5	5	5	5	5	5	5	5	5	5	6
Arsenic	8	8	8	8	8	8	8	8.8 u	8	8	50
Barium	37.1	34.6	8 j	5.5 j	7.7 j	10.7 j	7 j	6 j	47.5	48.1	2000
Beryllium	1	1	1	1	1	1	1	1	1	1	4
Cadmium	1	1	1	1	1	1	9.9	12.4	2.1	1.6	5
Calcium	90700	89700	98000	123000	328000	459000	56400	67500	21800	12100	n/a
Chromium	1	1	1	1	1	1	1	1	1	1	100
Cobalt	5.4	1.4	1	1	1	1	1	1	9.8	8.9	n/a
Copper	37 j	4	15 u	4	4	4	4	4	46	12 u	1300
Iron	5680	4630	447	1380	1830	23	26.7	23	2320	923	n/a
Lead	23.1	12.1	2	2	10.2	7.2	103	19.4	85.4	19.1	15
Magnesium	5490	5490	4990	6130	7900	9810	2750	3930	3020	1580	n/a
Manganese	504	490	352	378	1540	2130	6.2	4.3	790	754	200
Mercury	0.2 u	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	2
Nickel	5 u	1.3 u	1.7 u	1.2 u	1	1	1	1.2	8.7 u	3.4 u	100
Potassium	1130 u	1240 u	298 u	382 u	3390	2020	654 u	4500	1470 u	1230 u	n/a
Selenium	4	4	4	4	10.2	9.8	4	5.2	4	4	50
Silver	2	2	2	2	2	2	2	2	2	2	n/a
Sodium	3760 j	3600	1560 uj	1500 u	22700 j	15300	1780 uj	8650	4540 j	2380	n/a
Thallium	9 u	9 u	9 u	9 u	9 u	9 u	9 u	9 u	9 u	9 u	0.5
Vanadium	1.1 u	6 u	1	1	2.4 u	22.2	1	1	1	1	n/a
Zinc	630 j	602	240	349	28.5 j	37.6	1660 j	2320	521 j	344	n/a

Shaded areas depict those concentrations exceeding the MCL/Action Level.

FIGURES

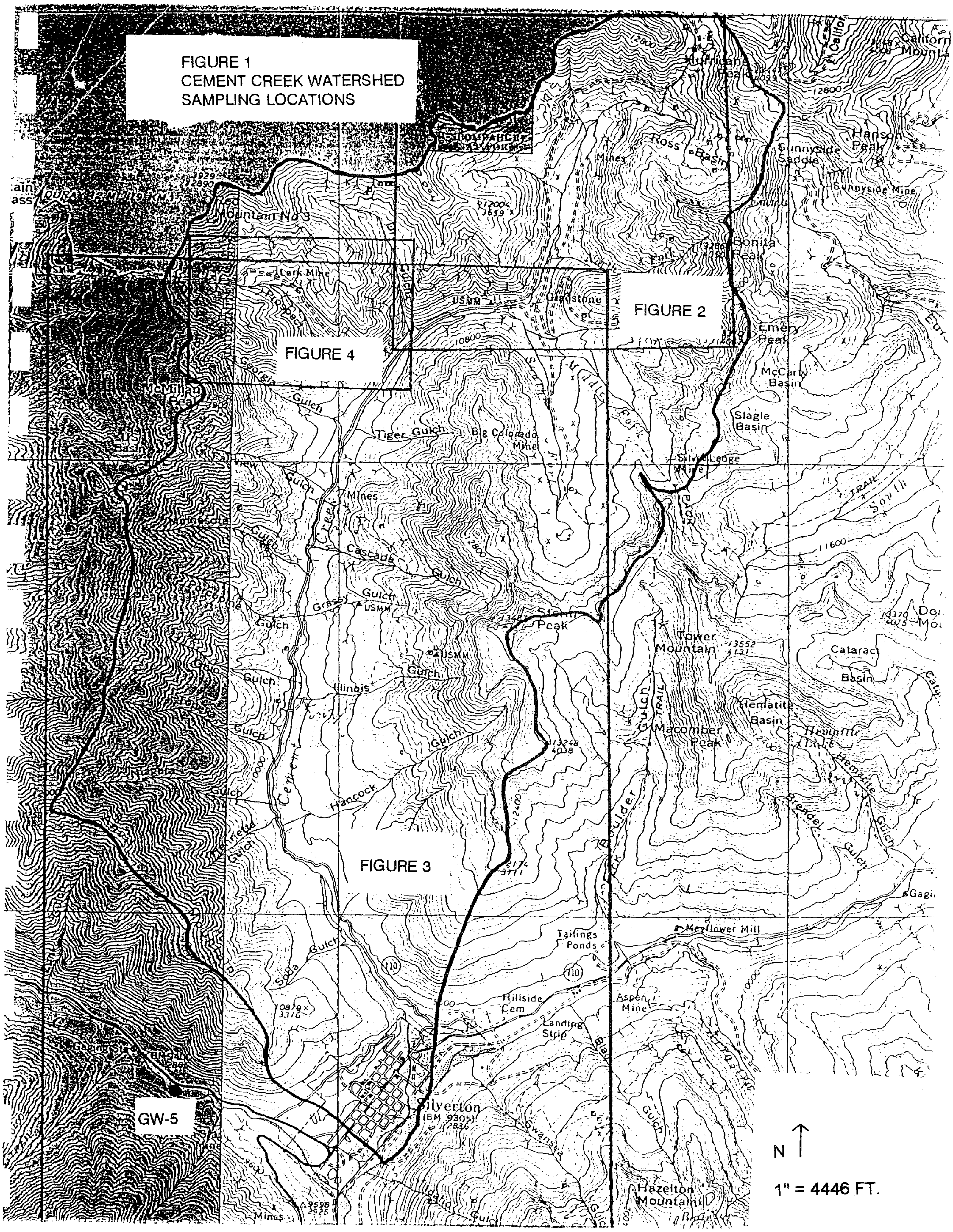
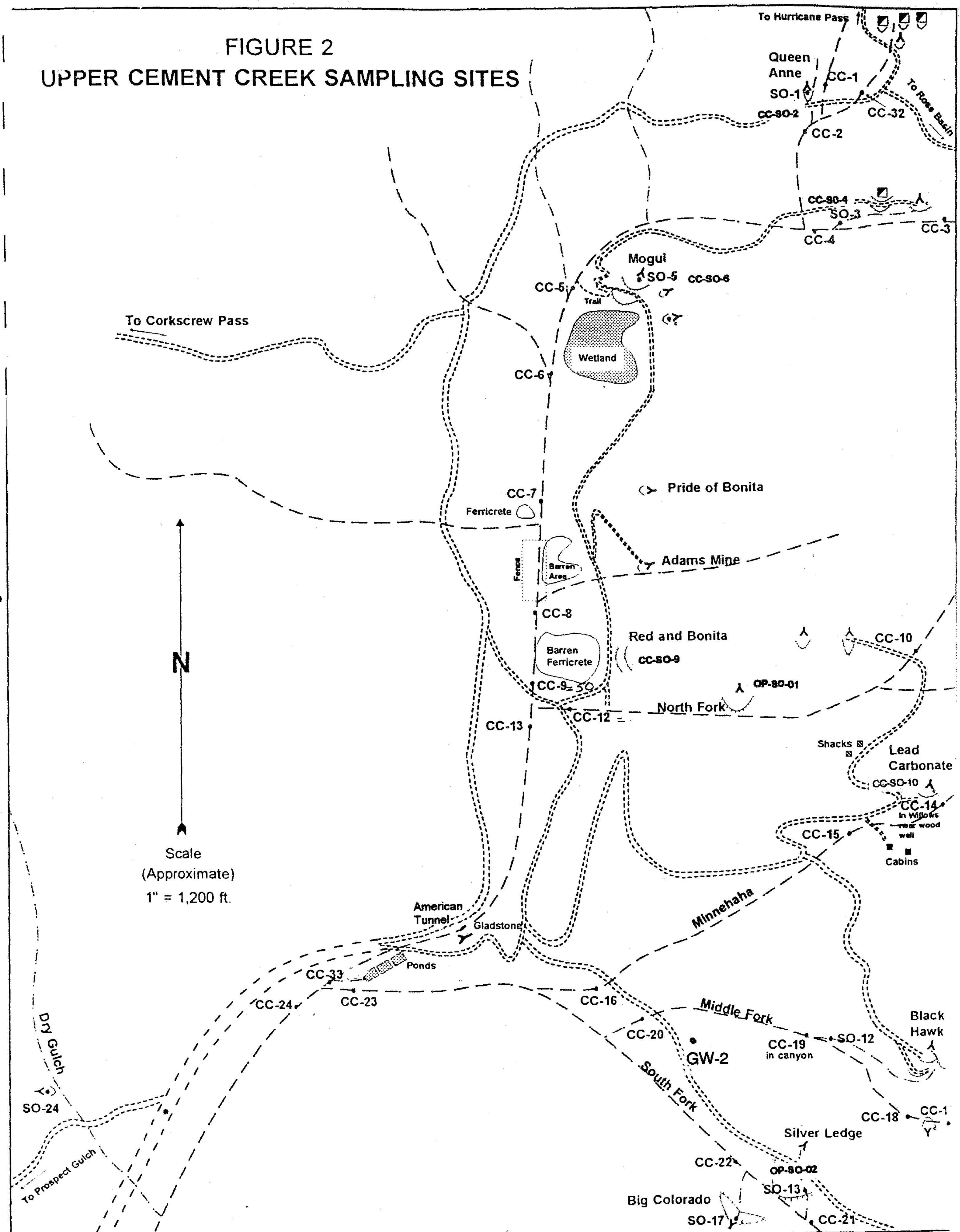


FIGURE 1
CEMENT CREEK WATERSHED
SAMPLING LOCATIONS
FIGURE 2
FIGURE 3
FIGURE 4
GW-5
N
1" = 4446 FT.
Hurricane Peak
Ross Basin
Sunnyside Saddle
Sunnyside Mine
Hanson Peak
Bonita Peak
Emery Peak
McCarty Basin
Slagle Basin
Silver Ledge Mine
Gladstone
USMM
Mines
Tiger Gulch
Big Colorado Mine
Georgia Gulch
Cascade Gulch
Grassy Gulch
Illinois Gulch
Hancock
Cement Creek
Storm Peak
Tower Mountain
Cataract Basin
Hematite Basin
Macomber Peak
Boulder Gulch
Tailings Ponds
Mayflower Mill
Hillside Cem
Landing Strip
Aspen Mine
Silverton
(BM 9305)
Soda Gulch
Swansea
Hazelton Mountain
Red Mountain No 3
Lark Mine
Prospect Gulch
110
12800
10800
11600
12400

1800733

FIGURE 2
UPPER CEMENT CREEK SAMPLING SITES



1800733

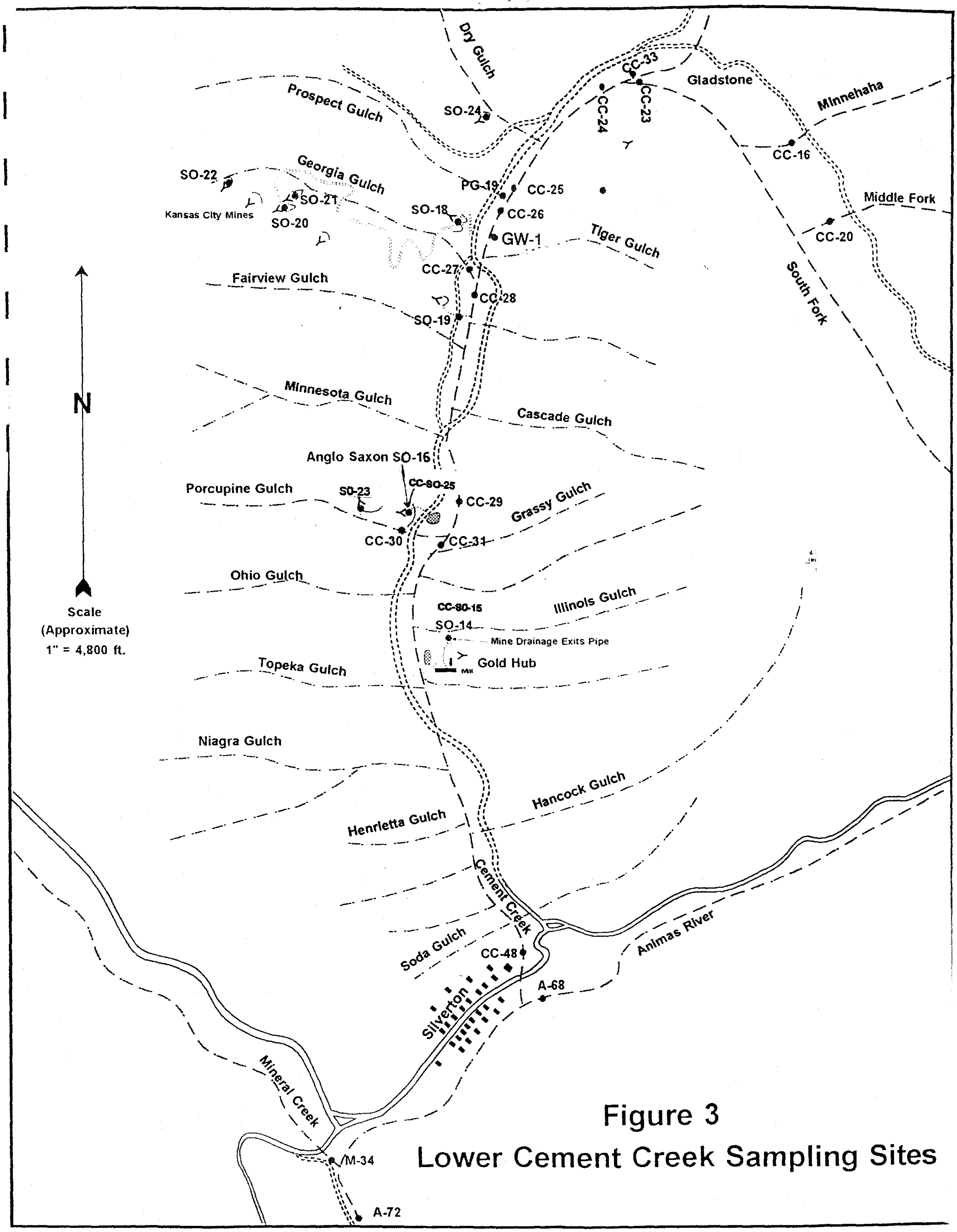
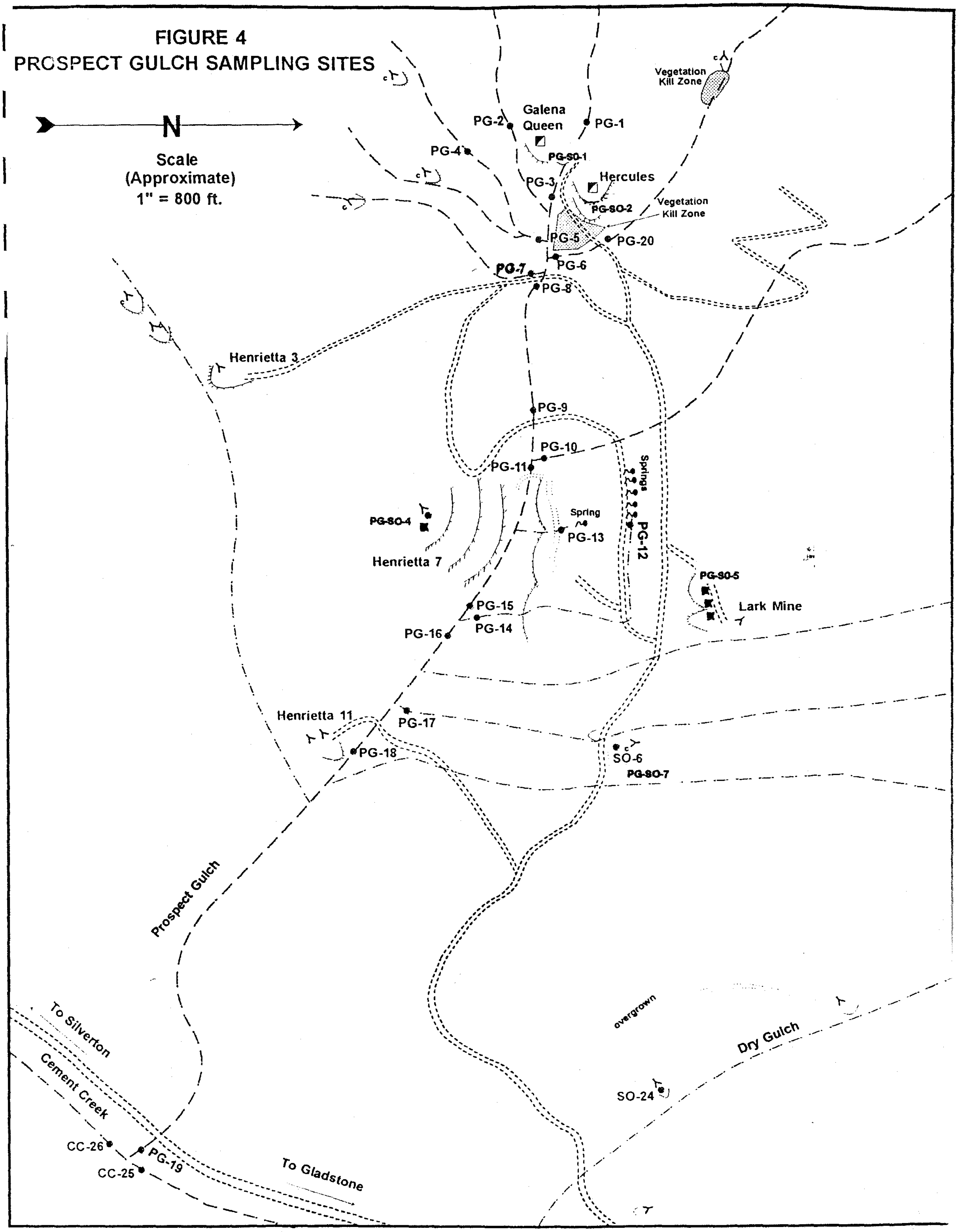


Figure 3
Lower Cement Creek Sampling Sites

1800733

ED 000552 00029910-00073

FIGURE 4
PROSPECT GULCH SAMPLING SITES



1800733

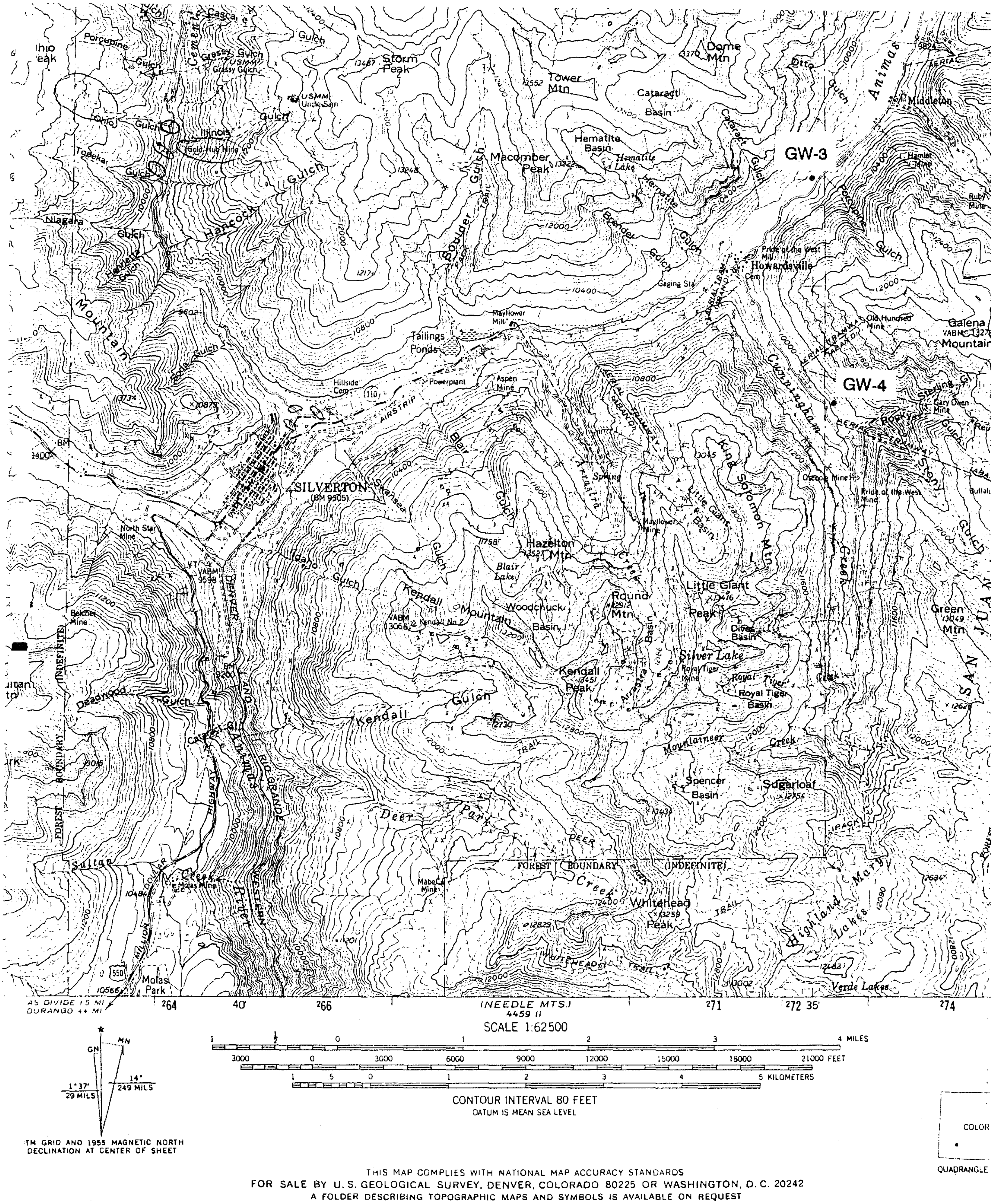


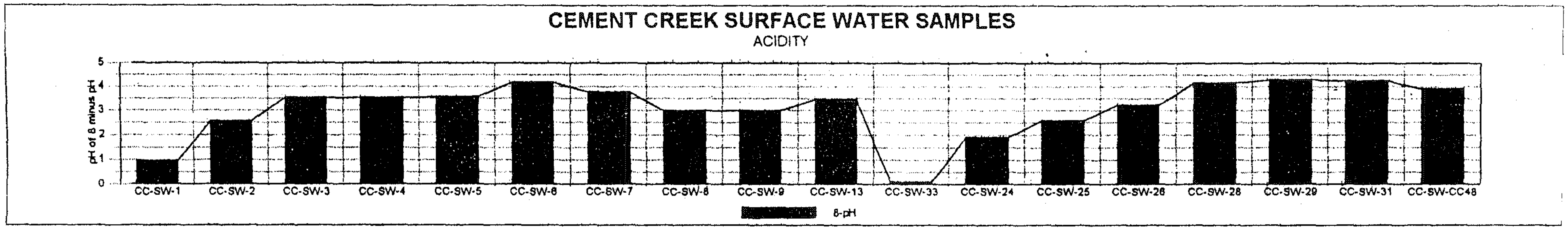
FIGURE 5
CEMENT CREEK WATERSHED
SAMPLING LOCATIONS

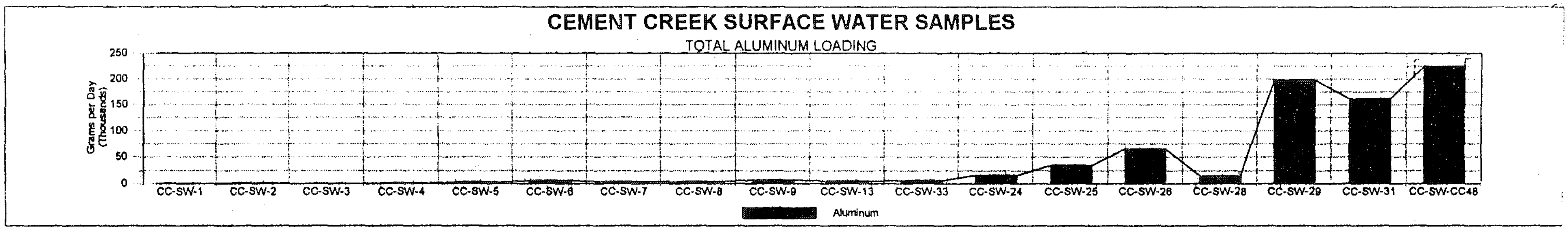
LEGEND FOR FIGURES

SAMPLE ID	SAMPLE TYPE	SAMPLE LOCATION
CC-SW-1	Surface Water - Background	Cement Cr. above Queen Anne Mine.
CC-SW-2	Surface Water	Cement Cr. below Queen Qnne Mine.
CC-SW-3	Surface Water - Background	Ross Basin above Unnamed Mine.
CC-SW-4	Surface Water	Ross Basin below Unnamed Mine.
SS-SW-5	Surface Water	Cement Cr. Above Mogul Mines.
CC-SW-6	Surface Water	Cement Cr. Below Mogul Mines.
CC-SW-7	Surface Water	Cement Cr. above Corkscrew G.
CC-SW-8	Surface Water	Cement Cr. Below Corkscrew G., above Red & Bonita Mine.
CC-SW-9	Surface Water	Cement Cr. Below Red & Bonita Mine, aobve N. Fork of Cement Cr.
CC-SW-13	Surface Water	Cement Cr. Below N. Fork.
CC-SW-33	Surface Water	Cement Cr. below American T./ Cement Cr. Treatment, above S. Fork
CC-SW-24	Surface Water`	Cement Cr. Below S. Fork.
CC-SW-25	Surface Water	Cement Cr. Above Prospect G.
CC-SW-26	Surface Water	Cement Cr. Below Prospect G.
CC-SW-28	Surface Water	Cement Cr. Below Georgia G.
CC-SW-29	Surface Water	Cement Cr. Above Porcupine G.
CC-SW-31	Surface Water	Cement Cr. Below Porcupine G.
CC-SW-CC48	Surface Water	Cemnet Cr. Above Animas R.
A	Draining mine/aqueous source	Queen Anne Mine
B	Draining mine/aqueous source	Henrietta (7) Mine
C	Draining mine/aqueous source	Mogul Mine
D	Draining mine/aqueous source	Dry Gulch Adit
E	Draining mine/aqueous source	Adit below Prospect G.
F	Draining mine/aqueous source	Kansas Sity #1 Adit
G	Draining mine/aqueous source	Adit below Georgia G.
H	Draining mine/aqueous source	Anglow Saxon Mine
I	Draining mine/aqueous source	Porcupine Adit

FIGURE 6

CEMENT CREEK: ALUMINUM LOADING vs. ACIDITY vs. SEDIMENT CONCENTRATION





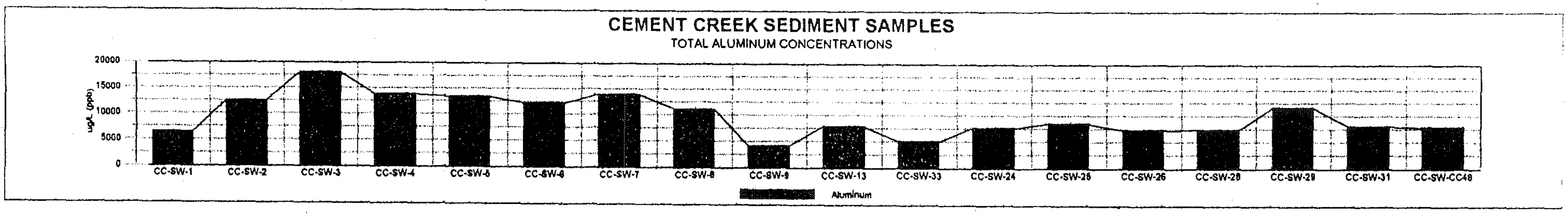
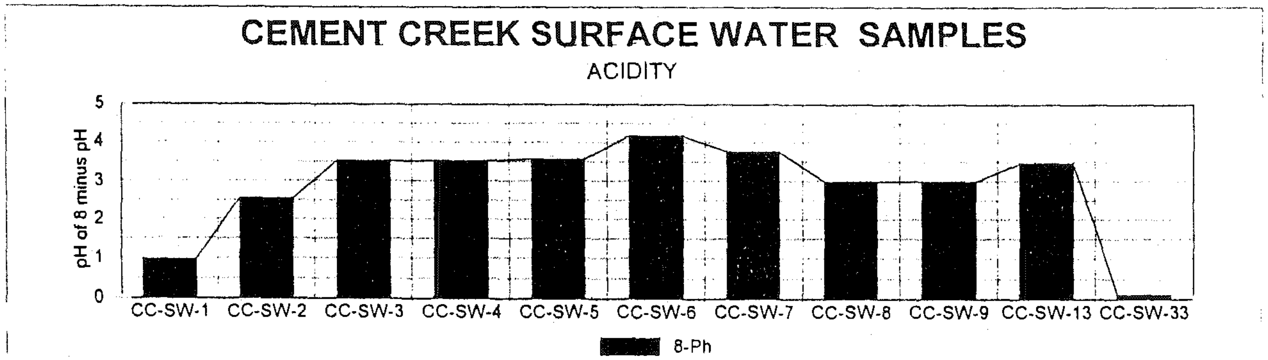
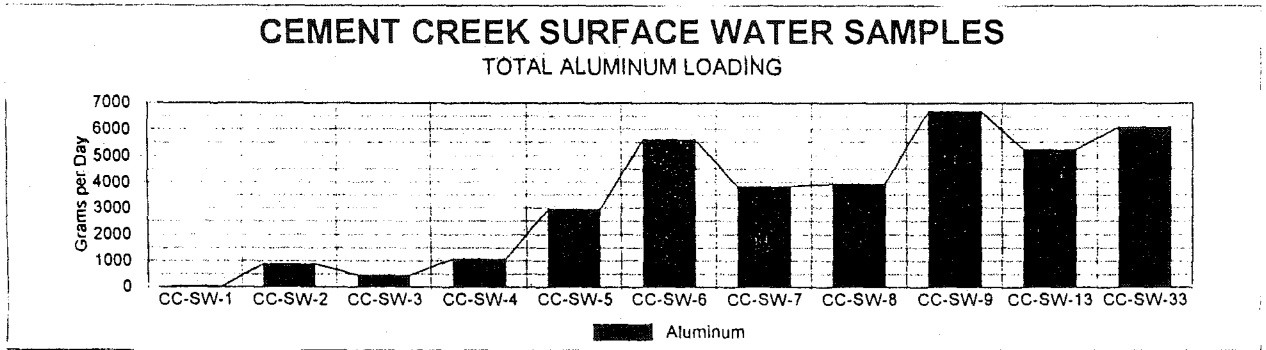


FIGURE 7

CEMENT CREEK: ALUMINUM LOADING vs. ACIDITY vs. SEDIMENT CONCENTRATION





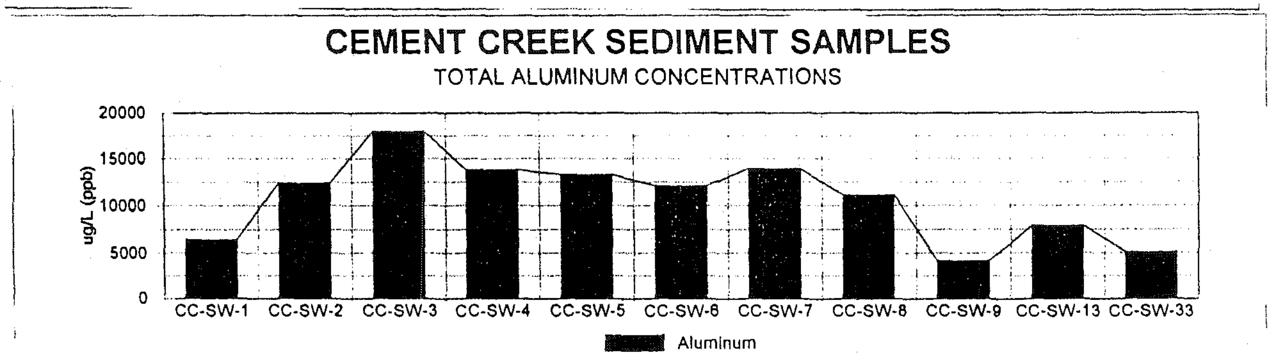
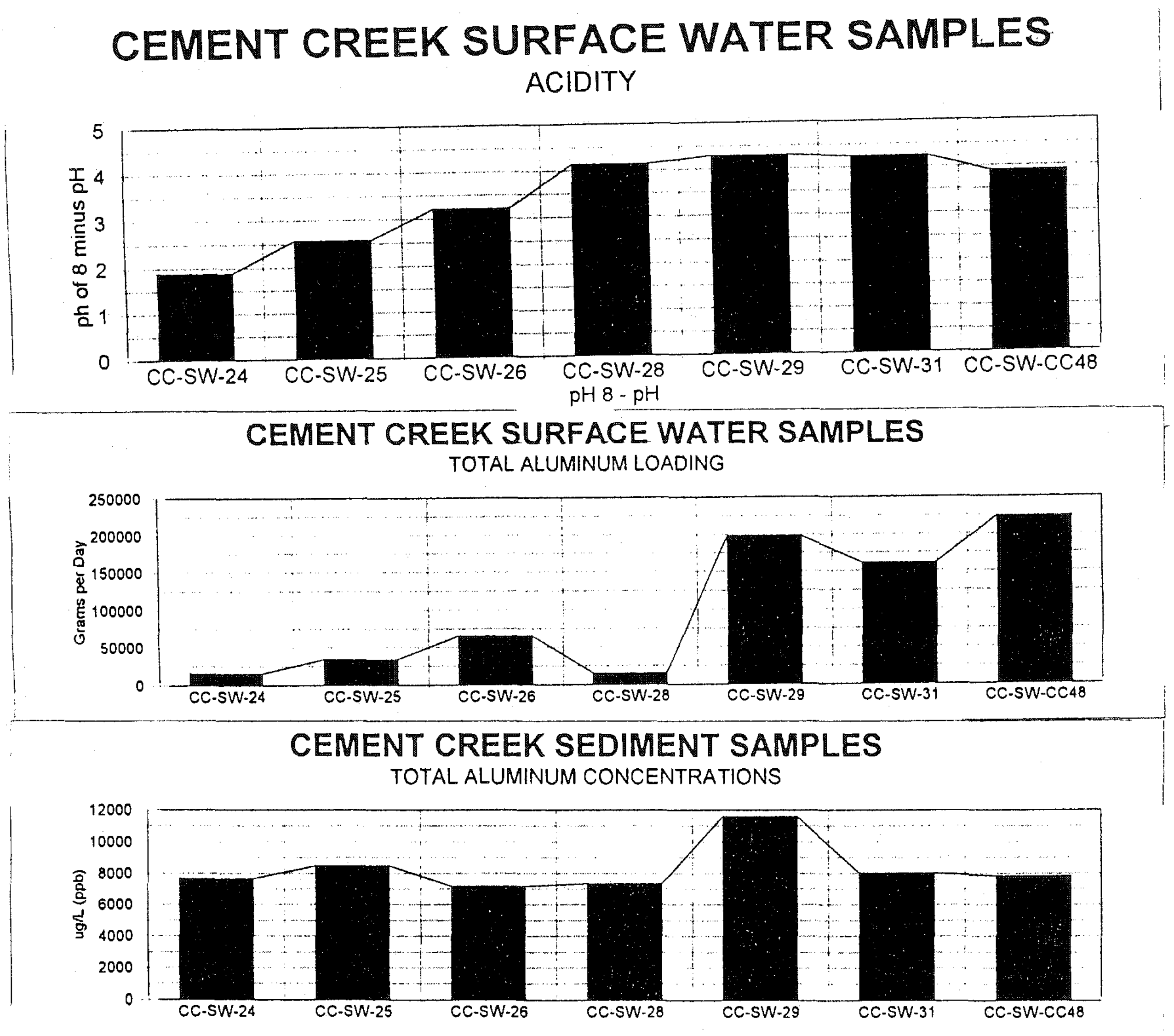


FIGURE 8
CEMENT CREEK: ALUMINUM LOADING vs. ACIDITY vs. SEDIMENT CONCENTRATION

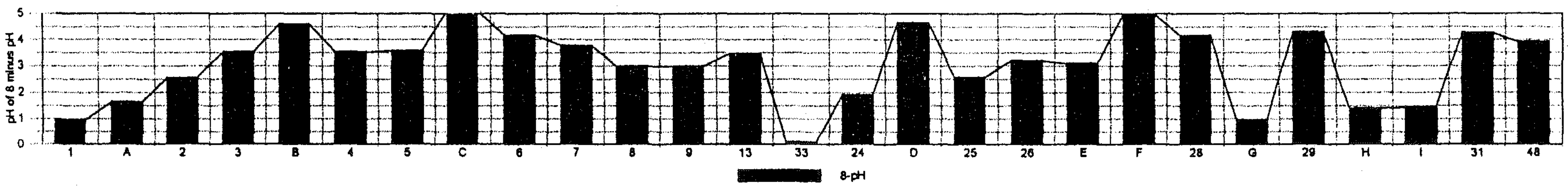


1800733

ED_000552_00029910-00079

FIGURE 9
CEMENT CREEK SURFACE WATER: ALUMINUM LOADING vs. ACIDITY
INCLUDING AQUEOUS SOURCE LOADINGS

CEMENT CREEK SURFACE WATER SAMPLES
ACIDITY



CEMENT CREEK SURFACE WATER SAMPLES
TOTAL ALUMINUM LOADING

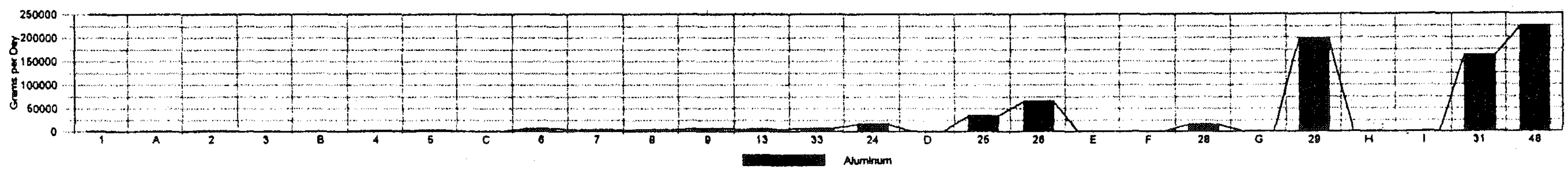
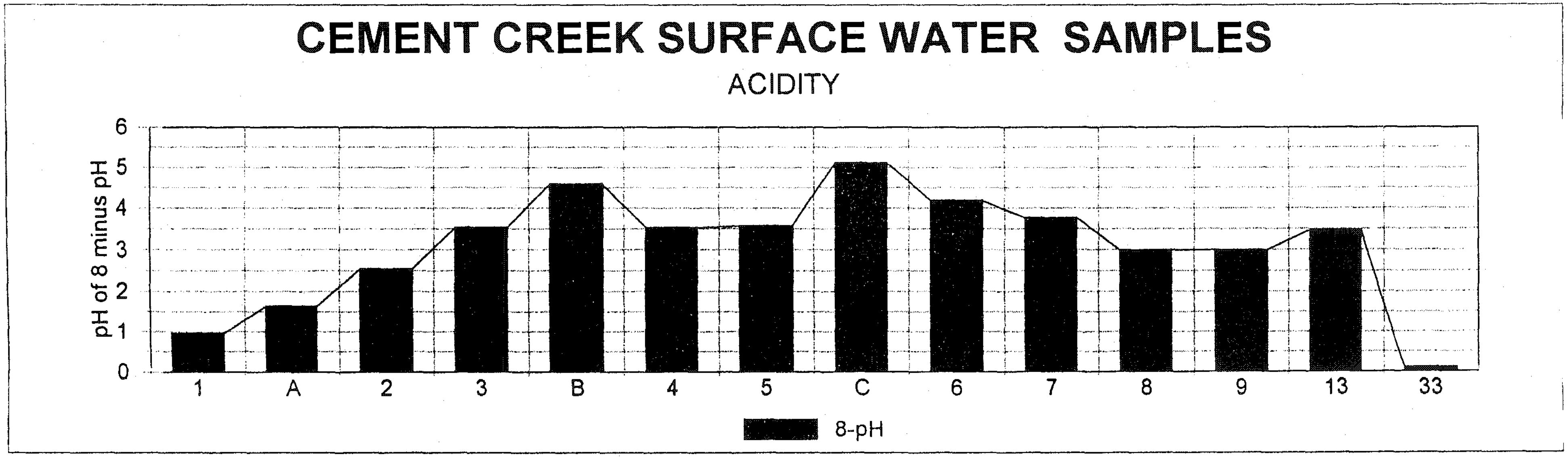


FIGURE 10
CEMENT CREEK SURFACE WATER: ALUMINUM LOADING vs. ACIDITY
INCLUDING AQUEOUS SOURCE LOADINGS



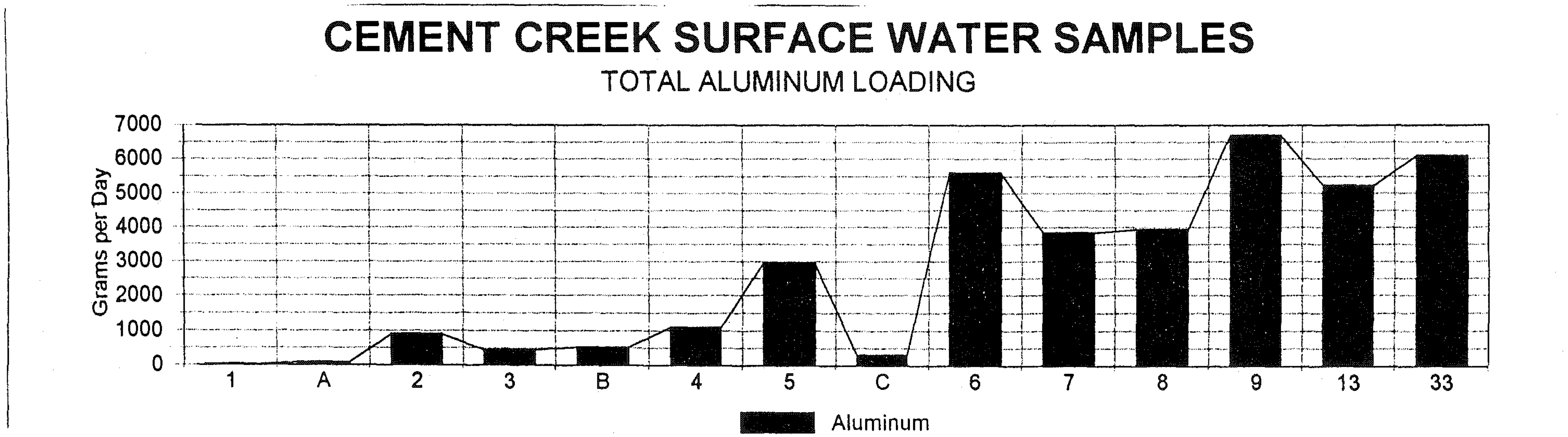
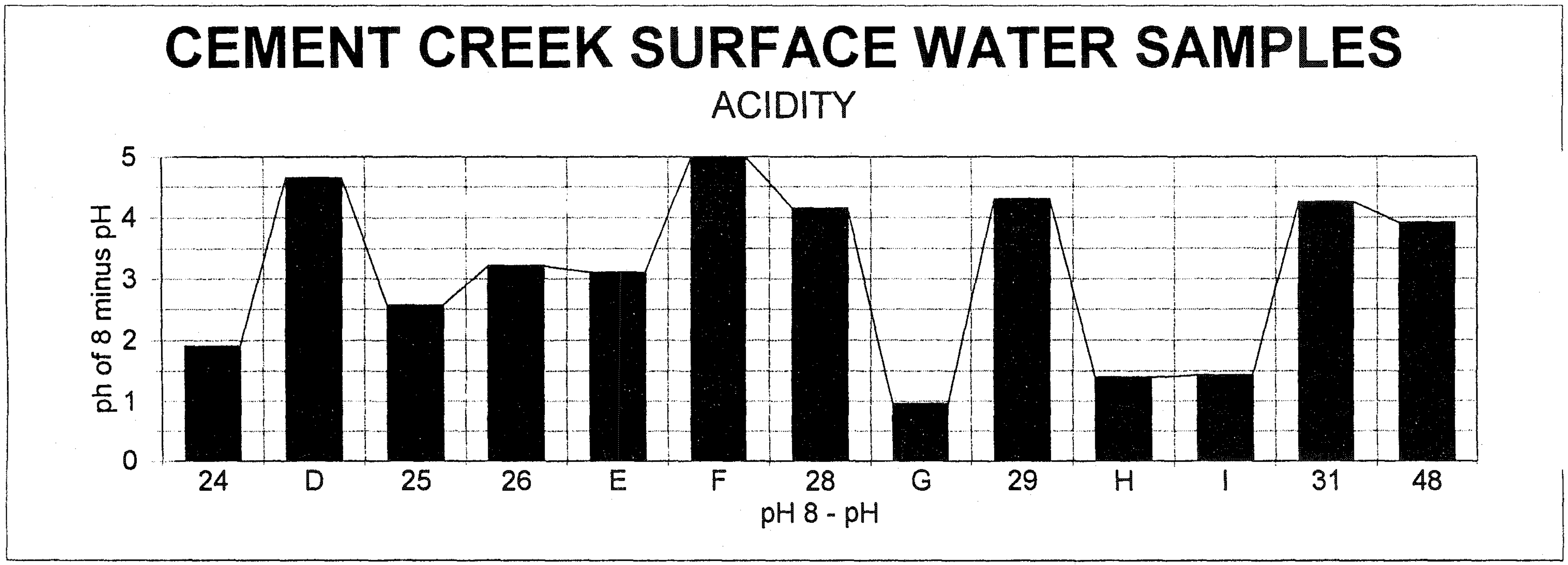


FIGURE 11
CEMENT CREEK SURFACE WATER: ALUMINUM LOADING vs. ACIDITY
INCLUDING AQUEOUS SOURCE LOADINGS



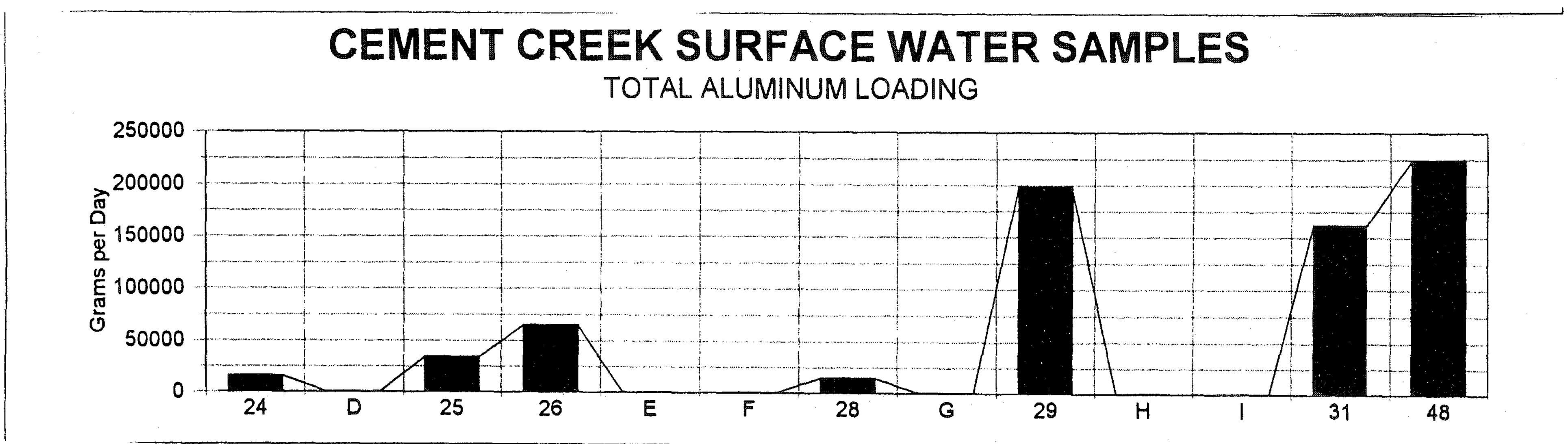
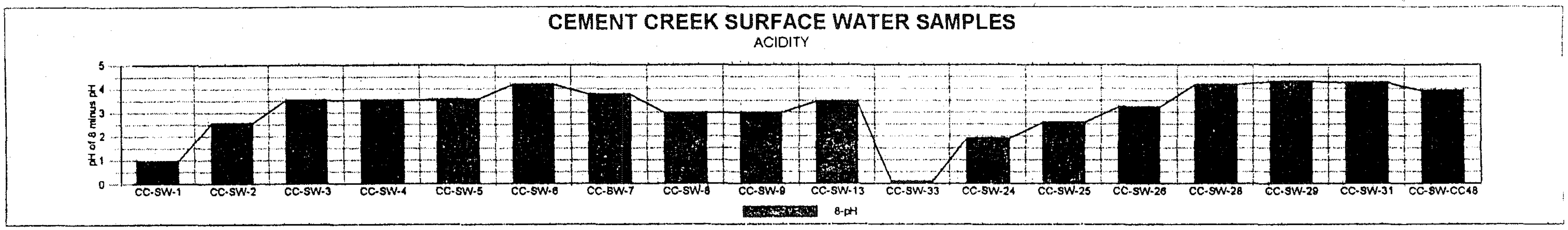
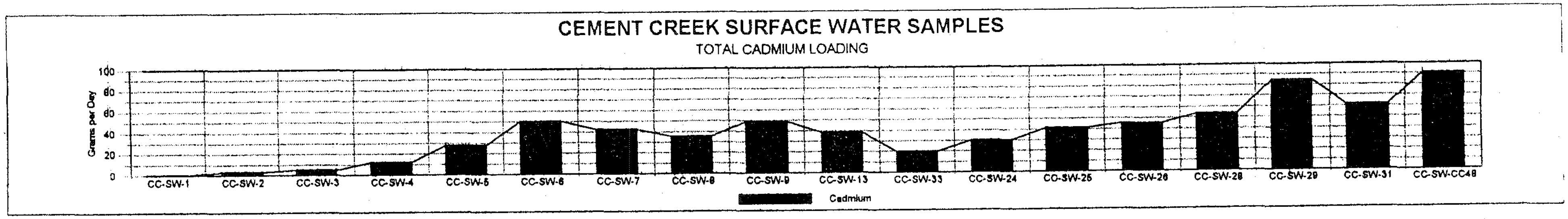


FIGURE 12

CEMENT CREEK: CADMIUM LOADING vs. ACIDITY vs. SEDIMENT CONCENTRATION





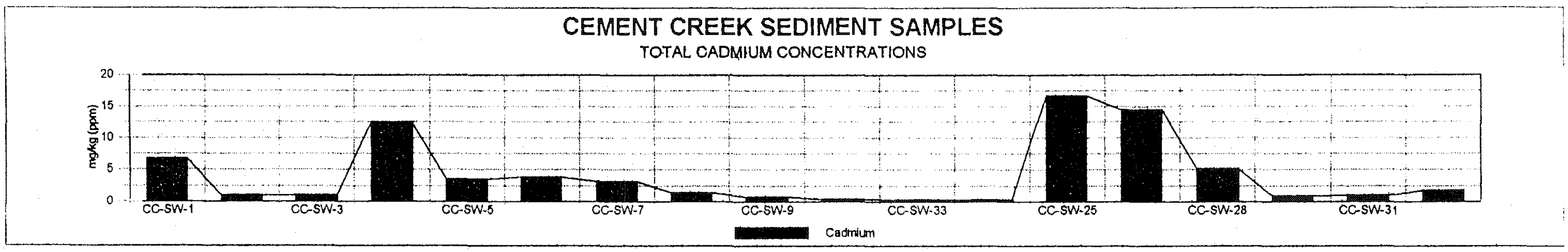
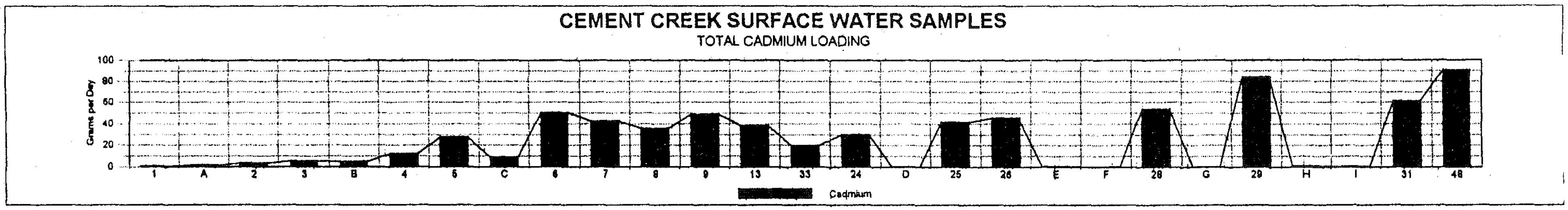
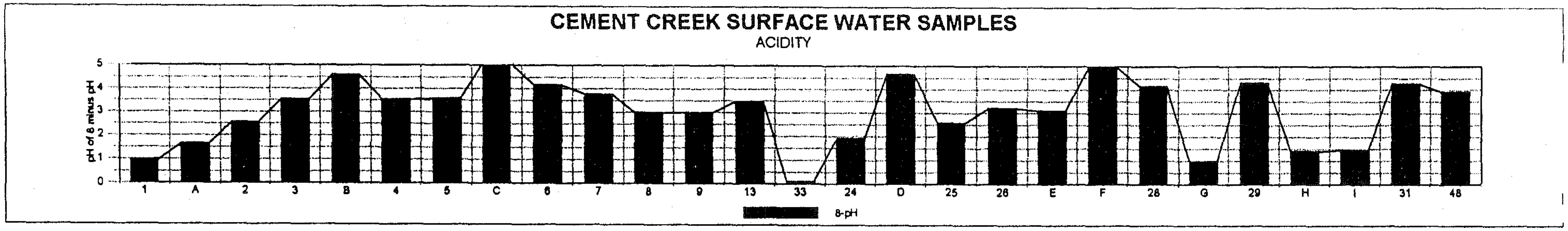


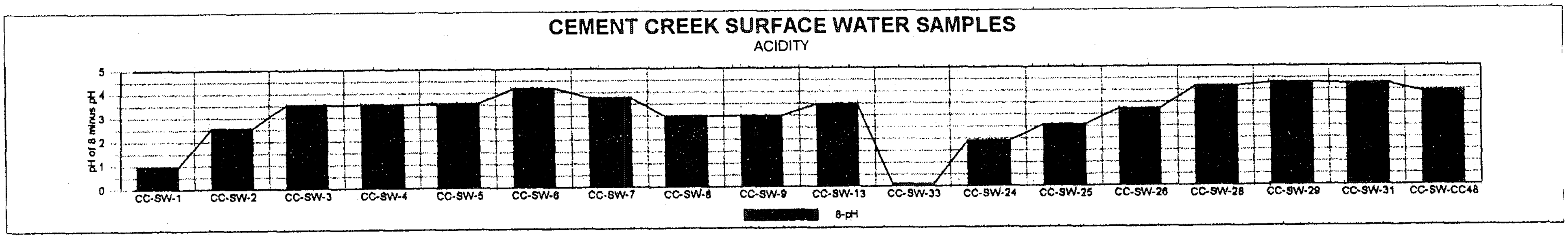
FIGURE 13
CEMENT CREEK SURFACE WATER: CADMIUM LOADING vs. ACIDITY
INCLUDING AQUEOUS SOURCE LOADINGS

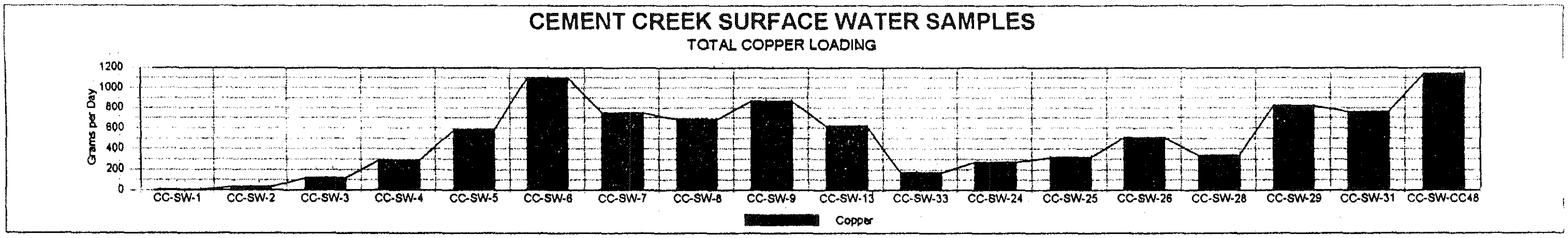


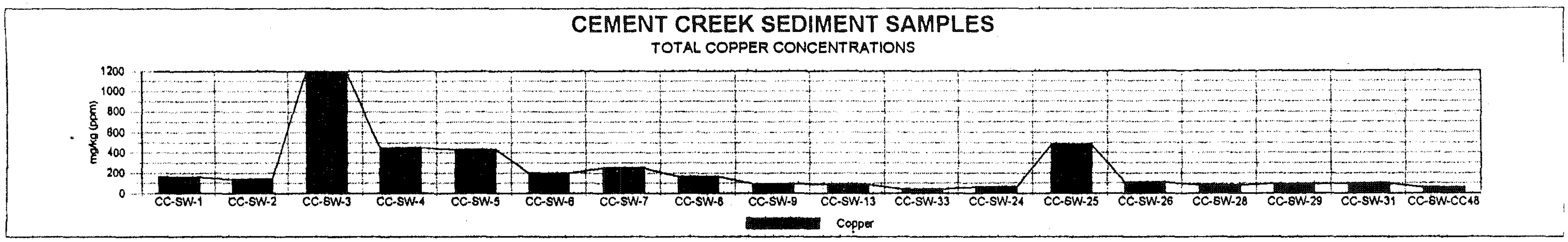


1800733

FIGURE 4
CEMENT CREEK: COPPER LOADING vs. ACIDITY vs. SEDIMENT CONCENTRATION



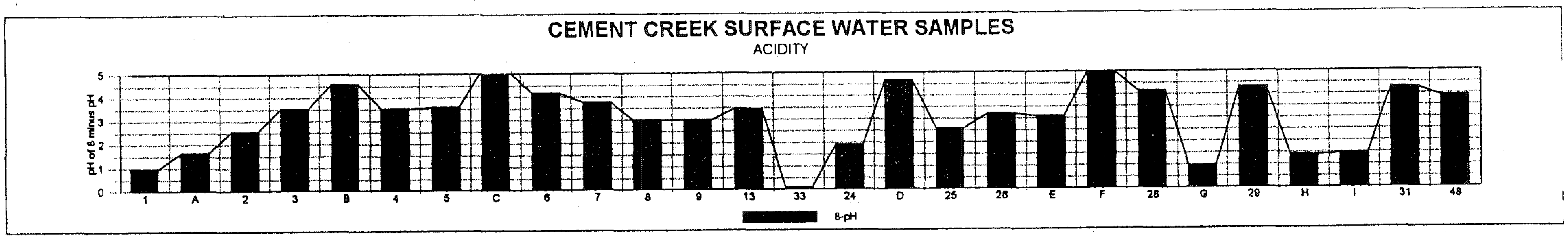


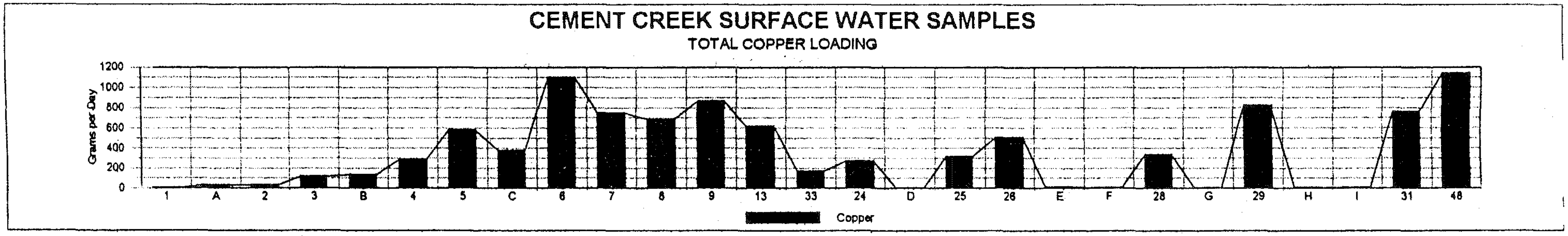


ED_000552_00029910-00085

1800733

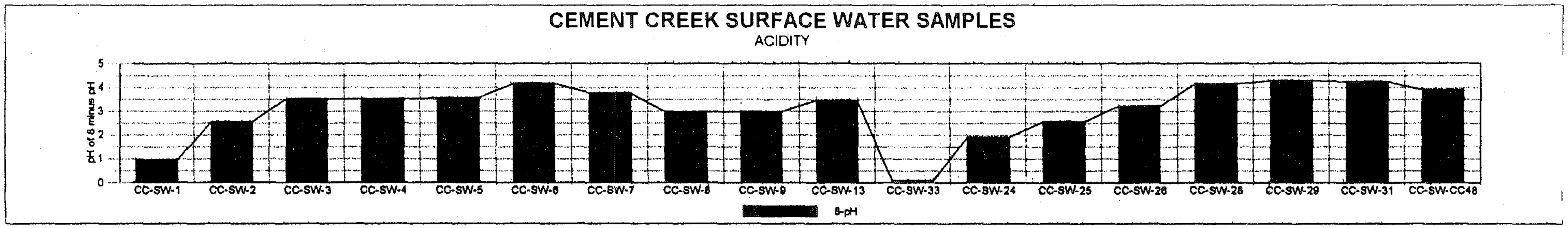
FIGURE 15
CEMENT CREEK SURFACE WATER: COPPER LOADING vs. ACIDITY
INCLUDING AQUEOUS SOURCE LOADINGS

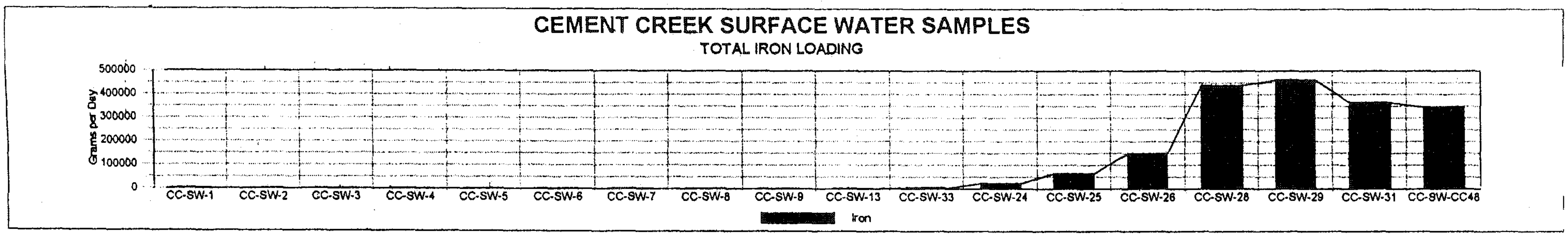




ED_000552_00029910-00086

FIGURE 16
CEMENT CREEK: IRON LOADING vs. ACIDITY vs. SEDIMENT CONCENTRATION





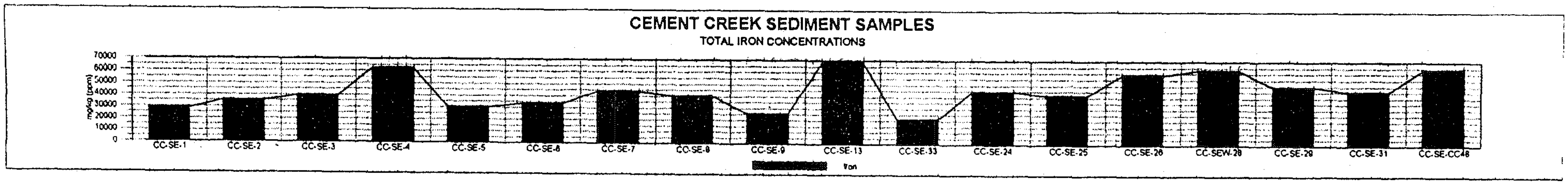


FIGURE 17
CEMENT CREEK: IRON LOADING vs. ACIDITY vs. SEDIMENT CONCENTRATION

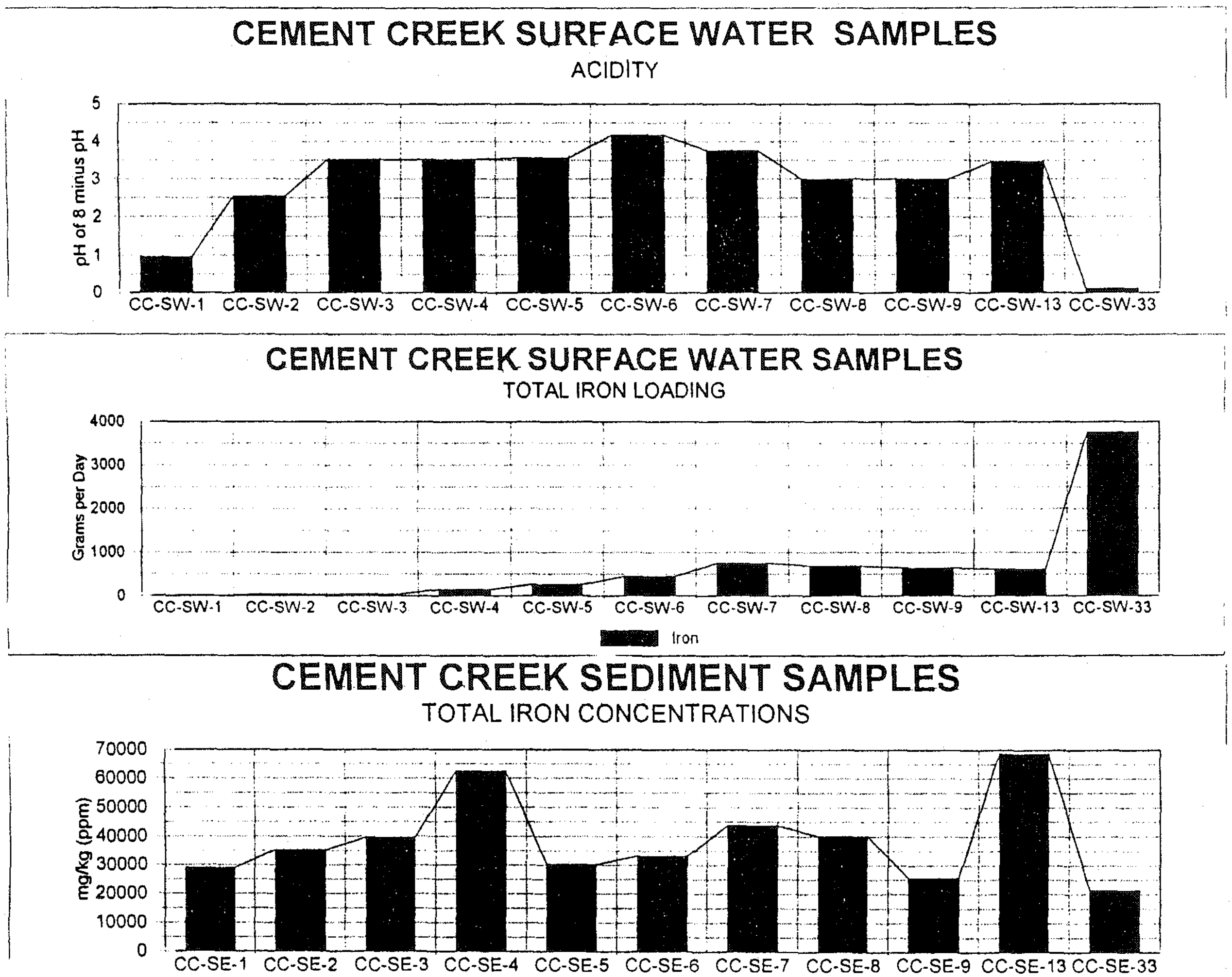


FIGURE 18
CEMENT CREEK: IRON LOADING vs. ACIDITY vs. SEDIMENT CONCENTRATION

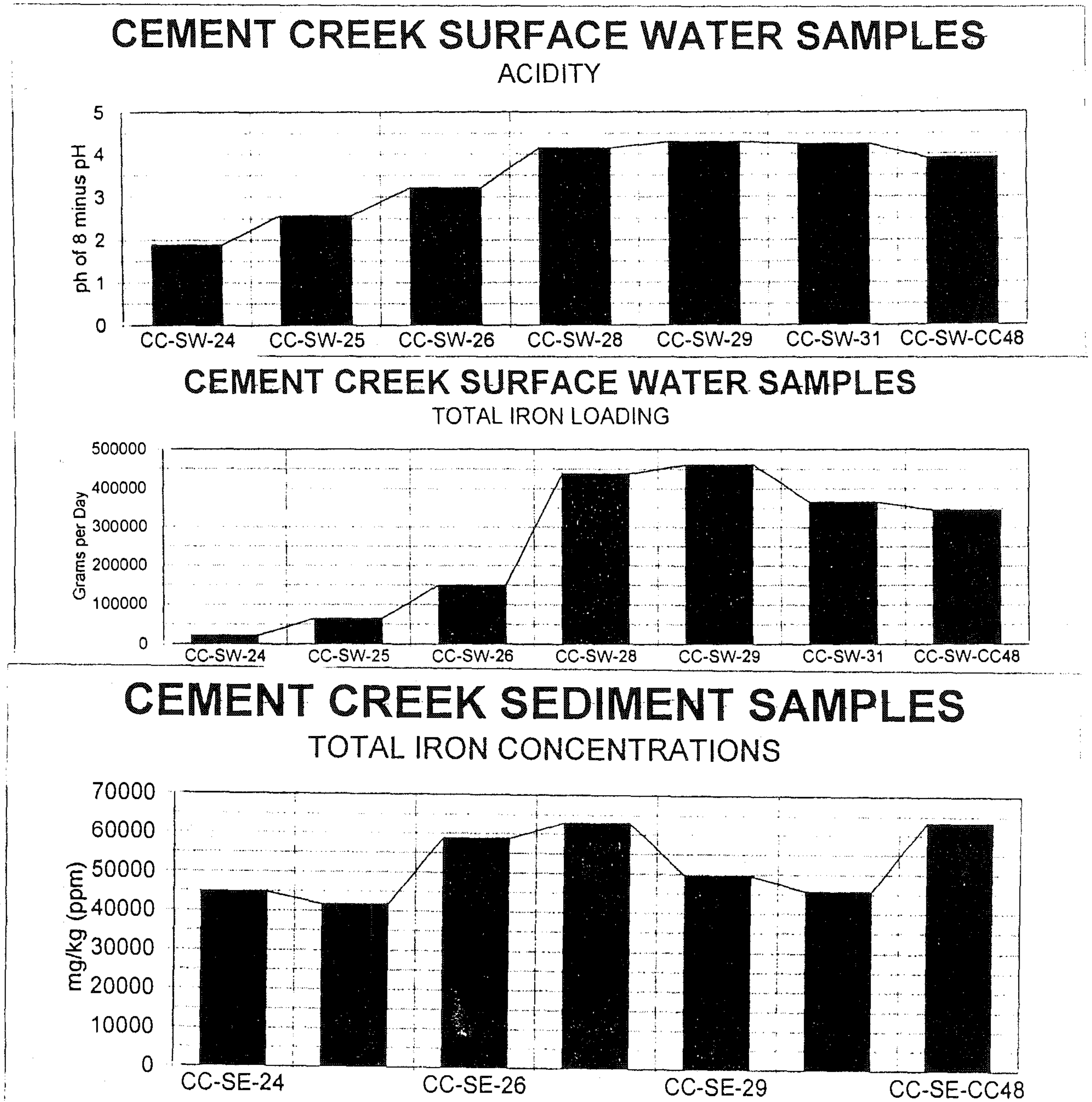
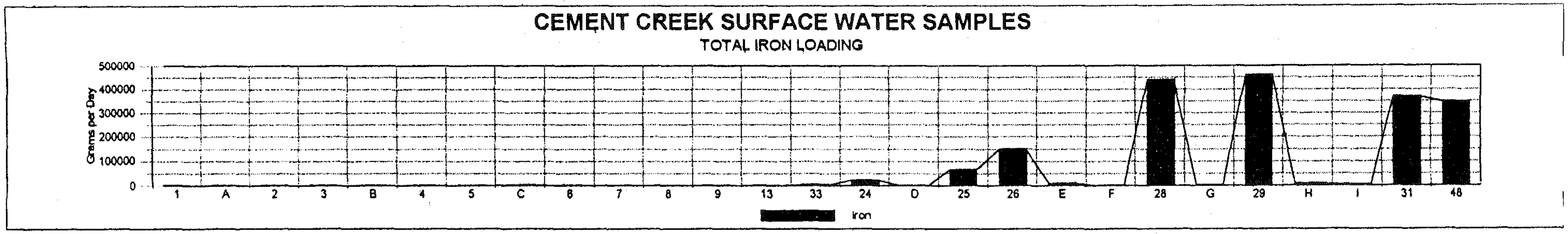


FIGURE 19
CEMENT CREEK SURFACE WATER: IRON LOADING vs. ACIDITY
INCLUDING AQUEOUS SOURCE LOADINGS



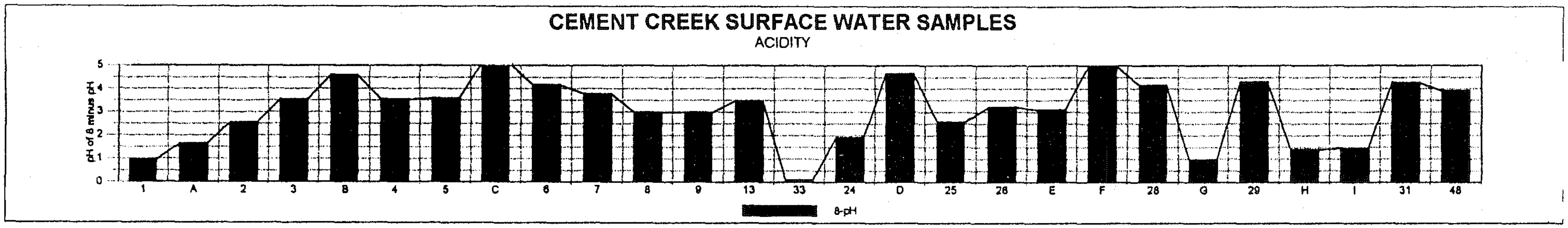
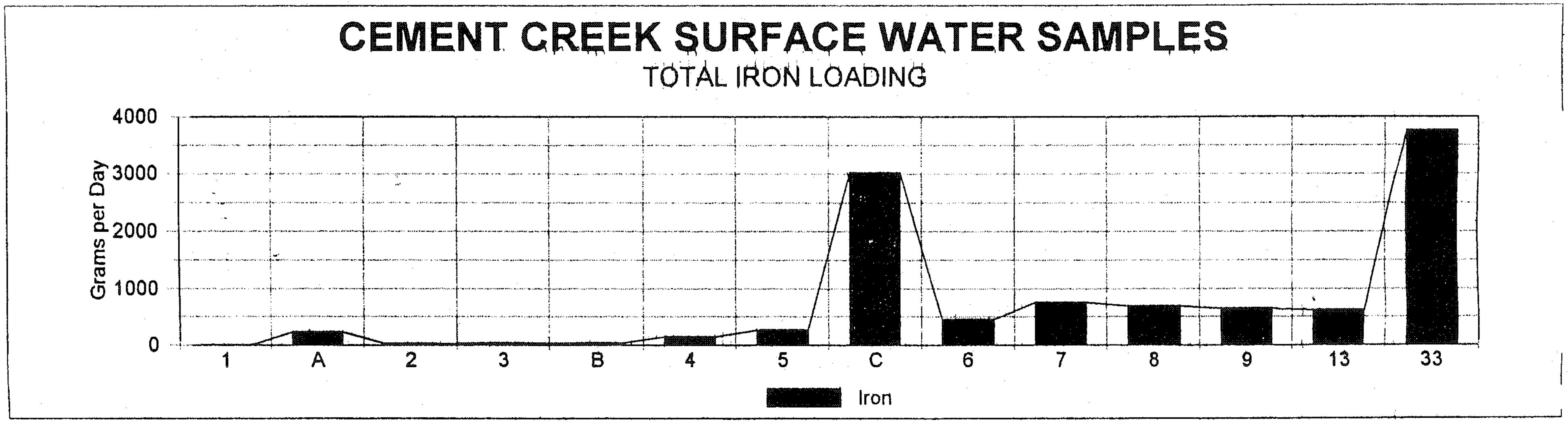


FIGURE 20
CEMENT CREEK SURFACE WATER: IRON LOADING vs. ACIDITY
INCLUDING AQUEOUS SOURCE LOADINGS



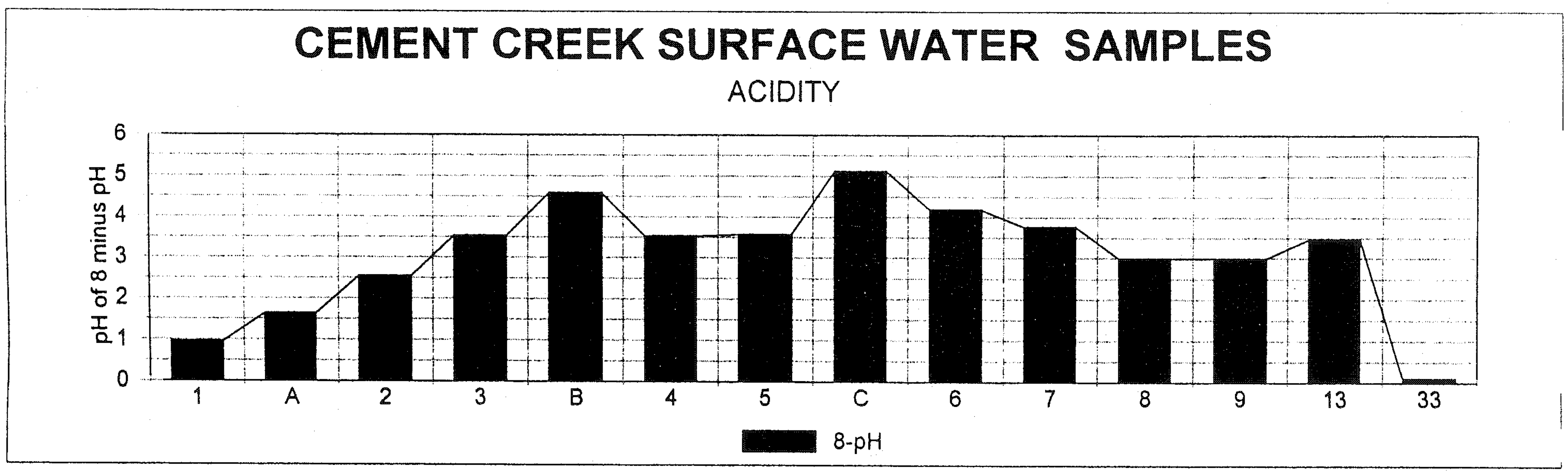
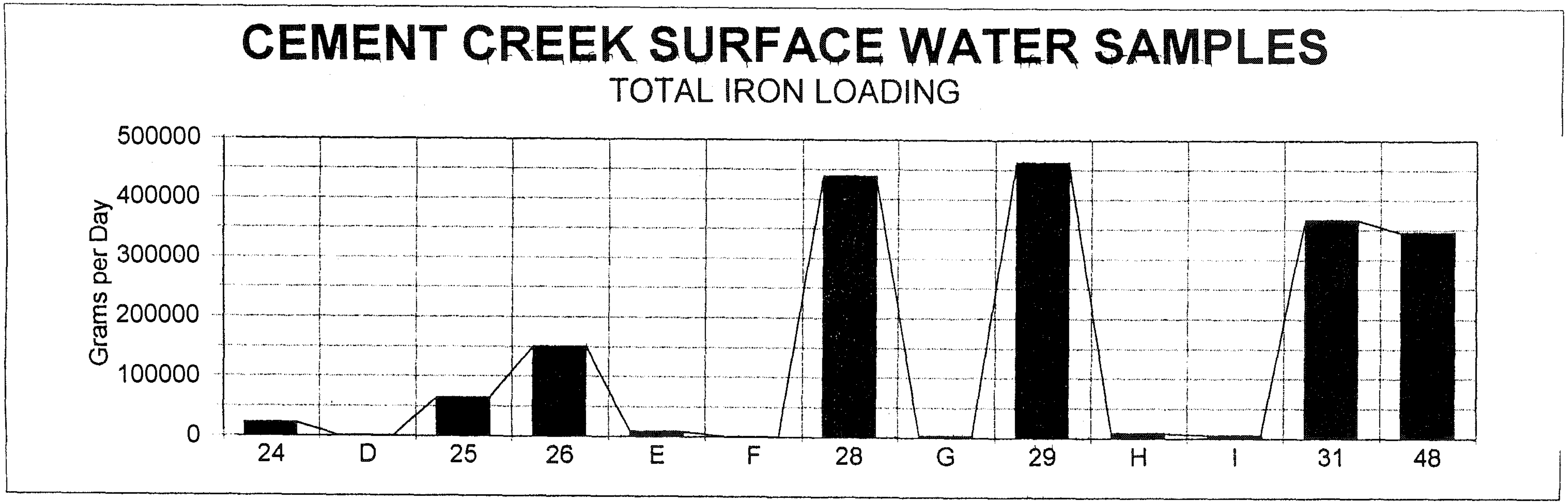
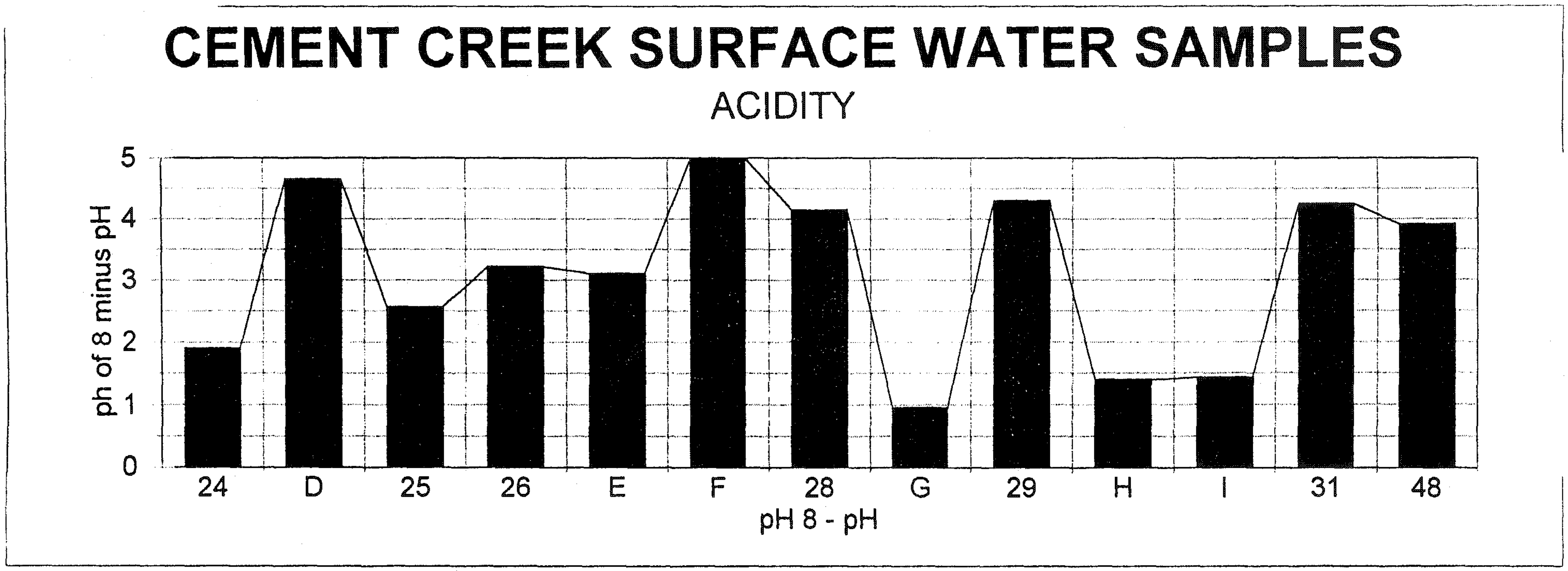
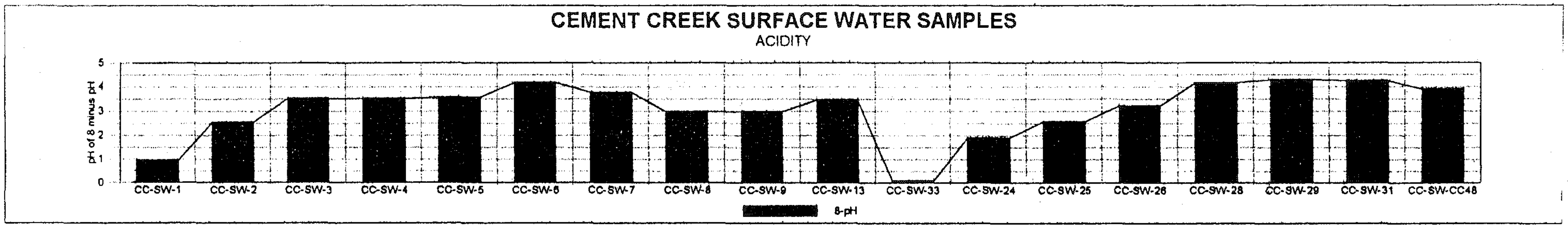


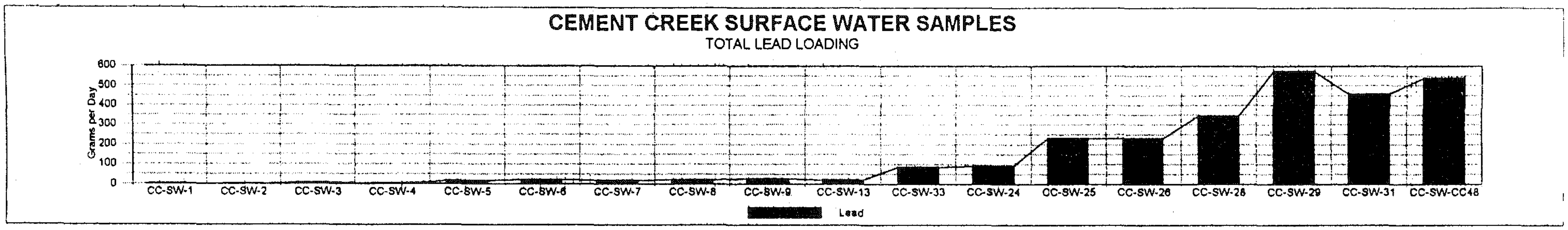
FIGURE 21
CEMENT CREEK SURFACE WATER: IRON LOADING vs. ACIDITY
INCLUDING AQUEOUS SOURCE LOADINGS

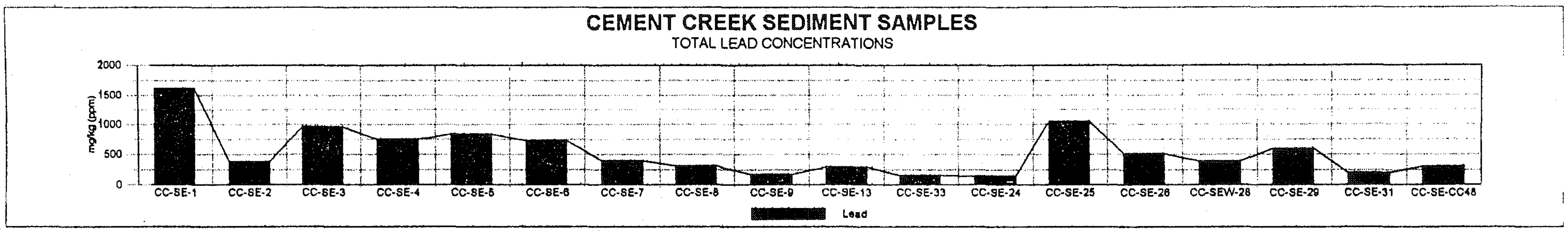




. .GU..L 22
CEMENT CREEK: LEAD LOADING vs. ACIDITY vs. SEDIMENT CONCENTRATION

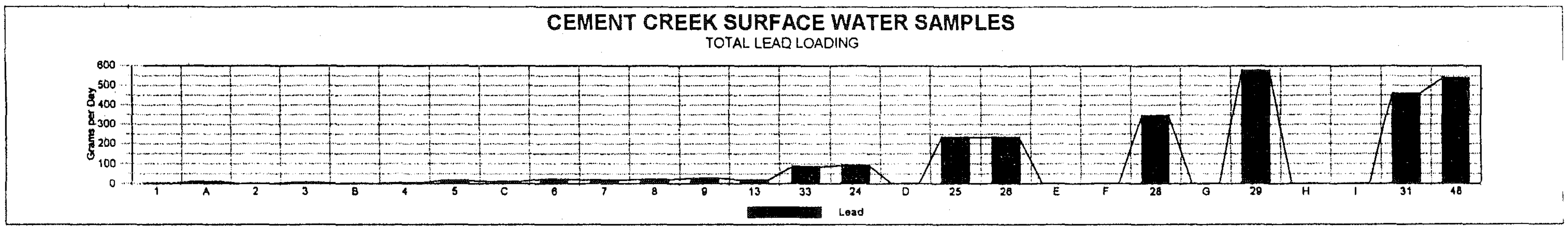


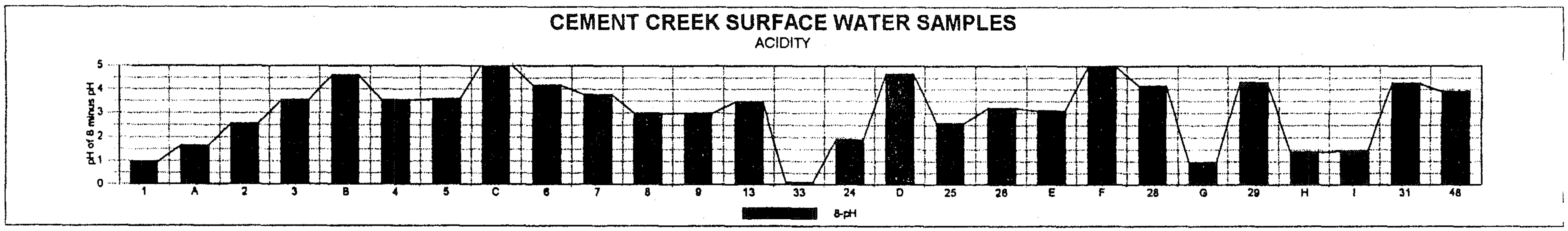




1800733

FIGURE 23
CEMENT CREEK SURFACE WATER: LEAD LOADING vs. ACIDITY
INCLUDING AQUEOUS SOURCE LOADINGS

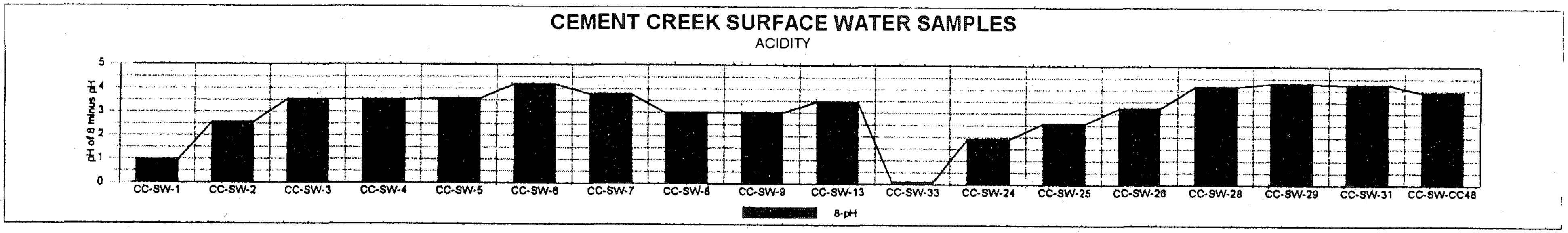


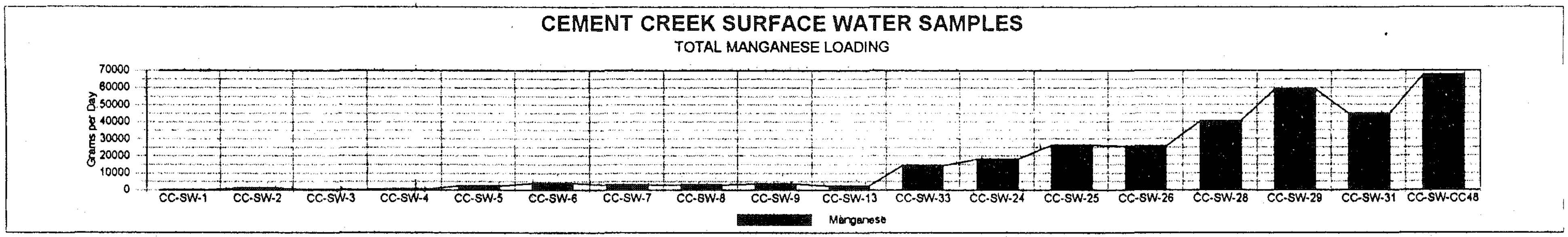


ED_000552_00029910-00094

GU 24

CEMENT CREEK: MANGANESE LOADING vs. ACIDITY vs. SEDIMENT CONCENTRATION





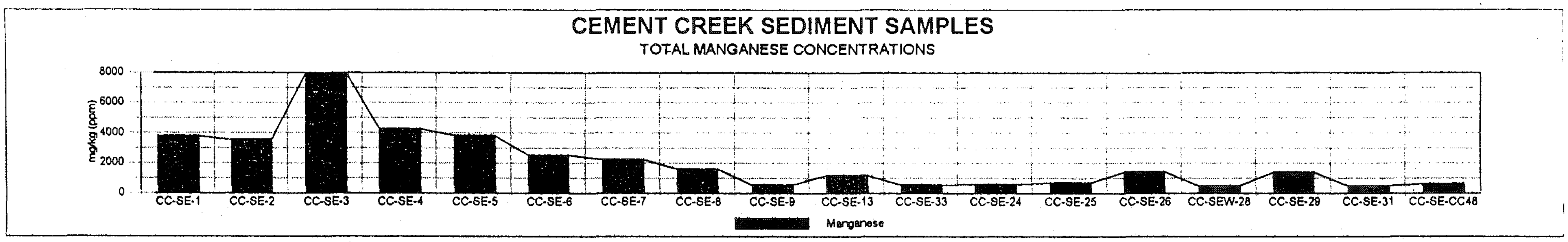
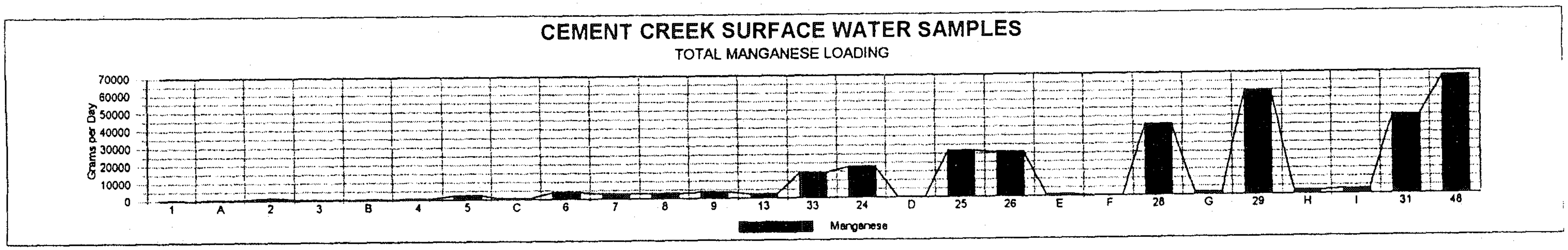
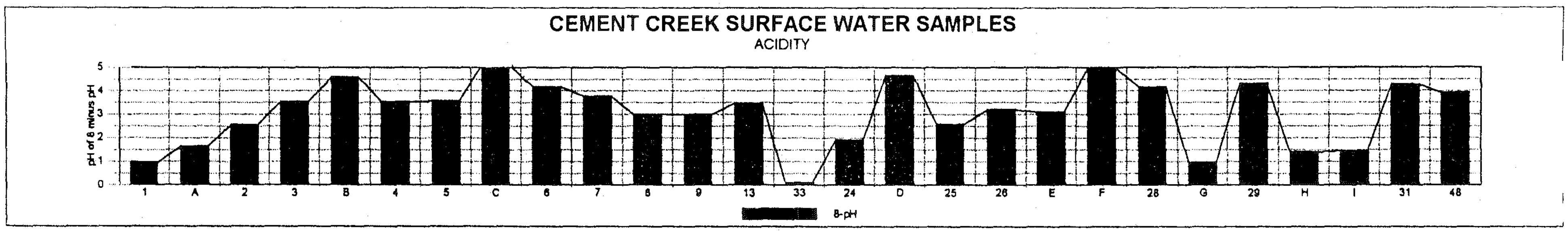


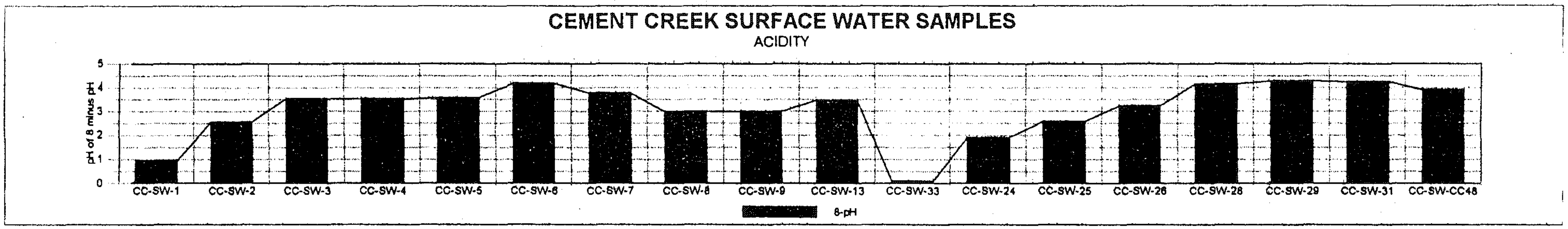
FIGURE 25
CEMENT CREEK SURFACE WATER: MANGANESE LOADING vs. ACIDITY
INCLUDING AQUEOUS SOURCE LOADINGS

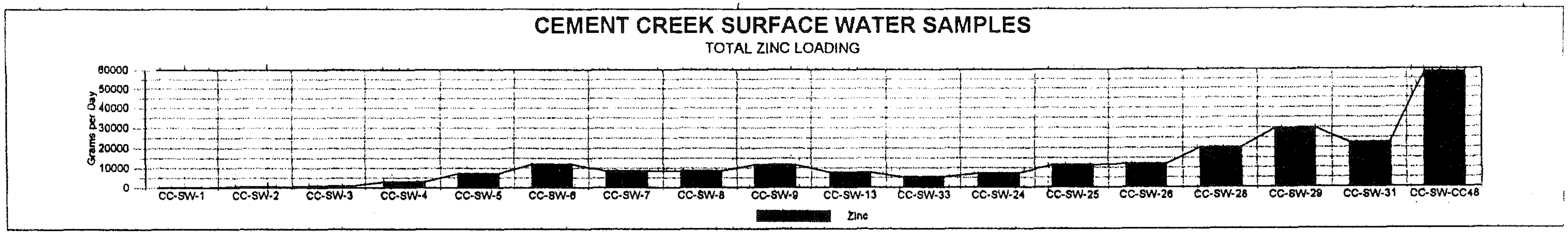


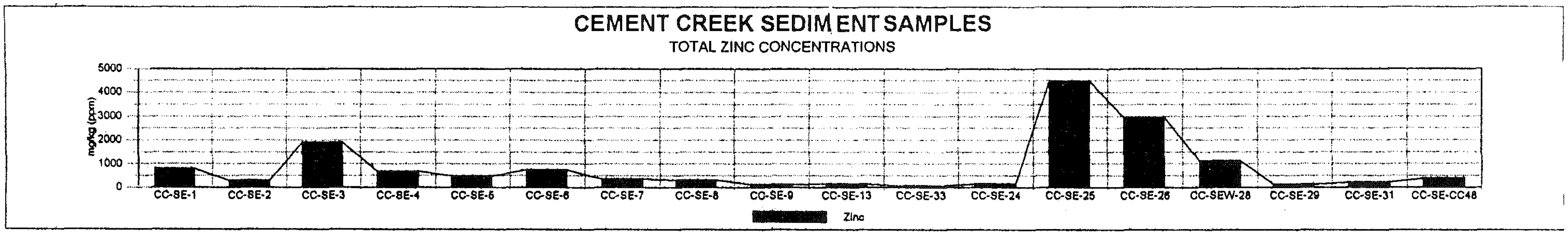


3U ▮26

CEMENT CREEK: ZINC LOADING vs. ACIDITY vs. SEDIMENT CONCENTRATION







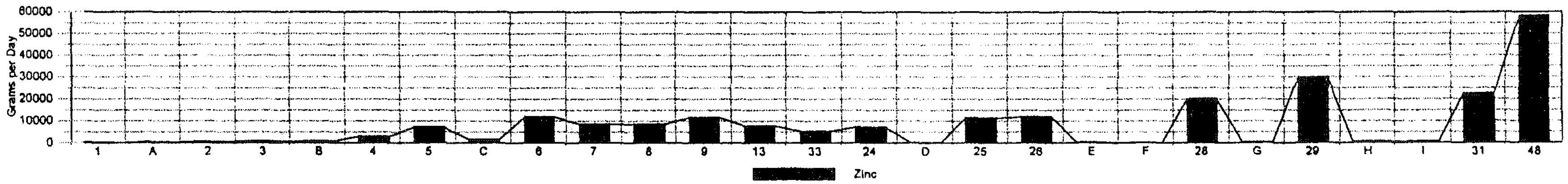
1800733

ED_000552_00029910-00097

FIGURE 27
CEMENT CREEK SURFACE WATER: ZINC LOADING vs. ACIDITY
INCLUDING AQUEOUS SOURCE LOADINGS

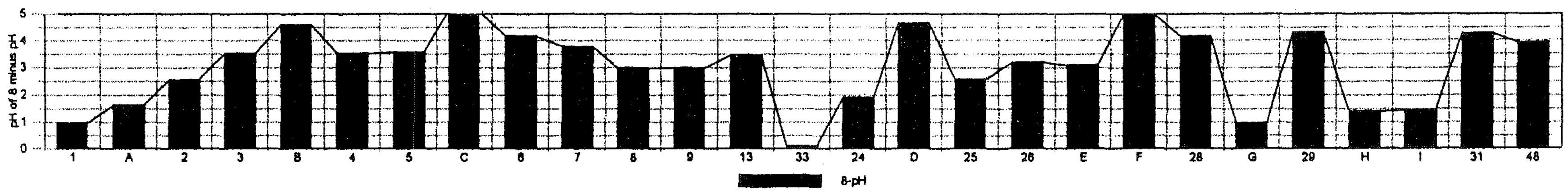
CEMENT CREEK SURFACE WATER SAMPLES

TOTAL ZINC LOADING



CEMENT CREEK SURFACE WATER SAMPLES

ACIDITY



APPENDIX A

Cement Creek Watershed Sampling Activities Report

STATE OF COLORADO

Roy Romer, Governor
Patti Shwayder, Acting Executive Director

Dedicated to protecting and improving the health and environment of the people of Colorado

Main Building
4300 Cherry Creek Dr. S.
Denver, Colorado 80222-1530
Phone (303) 692-2000

Laboratory Building
4210 E. 11th Avenue
Denver, Colorado 80220-3716
(303) 691-4700

Colorado Department
of Public Health
and Environment

October 31, 1996

Ms. Pat Smith
Site Assessment Manager
U.S. EPA, Superfund Technical Section
999 18th Street - Suite 500
Denver, Colorado 80202-2466

RE: Cement Creek Watershed Sampling Activities Report

Dear Pat,

Attached, please find a copy of the Cement Creek Watershed Sampling Activities Report.

Please contact me with any questions, comments or concerns. I can be reached at (970) 728-5487 or at P.O. Box 2927, Telluride, Colorado 81435.

Thank you.

Sincerely,

Camille M. Farrell
State Project Officer
Environmental Protection Specialist

cc: Martin O'Grady
Dan Scheppers, CDPHE

TABLE OF CONTENTS

LIST OF TABLES

FIGURES

DRAFT

APPENDIX A SITE PHOTOGRAPHS

SITE INSPECTION
SAMPLE ACTIVITIES REPORT
CEMENT CREEK WATERSHED
SAN JUAN COUNTY, COLORADO
CO 0001411347

1.0 INTRODUCTION

The Hazardous Materials and Waste Management Division (HMWMD) of the Colorado Department of Public Health and Environment (CDPHE) conducted sampling activities as part of a Site Inspection (SI) of the Cement Creek Watershed, located near the Town of Silverton, in San Juan County, Colorado. The SI was performed by CDPHE under a Cooperative Agreement with the U.S. Environmental Protection Agency, Region VIII (EPA). This SI was designed to bridge with sampling efforts of the Colorado Division of Minerals and Geology's (DMG) Non Point Source *Animas River Targeting Continuation Project*, as possible under a routine SI.

Site reconnaissance and sampling of mine waste rock source characterization samples were conducted between August 6 and 8, 1996. Ground water sampling activities were carried out on September 16 and 17, 1996. Aqueous and sediment sampling activities occurred on September 30, October 1 and 2, 1996. The sampling was performed in accordance with the Cement Creek Watershed Sample and Analysis Plan (CDPHE, 1996), approved by EPA on July 26, 1996, except as noted in Section 3.0 of this report, entitled "Deviations from the Sample Plan".

This report documents activities conducted in the field including field observations, sample locations, and recorded field parameters. Deviations from the approved sample plan are documented as well as the rationale. For a more complete discussion of the site history or sampling rationale, the reader is referred to the Cement Creek Watershed Sample and Analysis Plan (CDPHE, 1996).

2.0 SAMPLING ACTIVITIES

Mine waste rock source characterization samples were collected by one CDPHE employee between August 6 and 8, 1996. Ground water samples were collected on September 16 and 17, 1996 by one CDPHE employee. The aqueous and sediment component of the sampling activities were carried out in the Cement Creek Watershed by three CDPHE employees and two volunteers on September 30, October 1 and 2, 1996. Five vehicles were used to transport sampling equipment, sample containers, coolers, and personnel to the site.

Sample containers for aqueous metals, cyanide, total organic carbon and volatile organics analyses were preserved in the field. Bottles used to contain aqueous samples for metals analyses were preserved with nitric acid, bottles used to contain aqueous samples for cyanide analyses were preserved with sodium hydroxide, bottles used to contain aqueous samples for total organic carbon analyses were preserved with sulfuric acid, while those for volatile organics analyses were preserved with hydrochloric acid. Jars used to contain source and sediment samples for analyses of the above constituents were not preserved.

All jars and bottles were labelled before sampling. Traffic Reports were completed before sampling. Upon collection, all samples were immediately placed in coolers with ice; prior to shipment, the coolers were drained of excess water and repacked with ice. The samples were shipped via Federal Express overnight delivery in four shipments; ground water samples were shipped on September 19, 1996, 1100 hours; organic samples (10% of sediments collected by CDPHE and 10% of the aqueous samples collected by DMG) were shipped on October 3, 1996, 1430 hours; inorganic (sediments, source characterization, and cyanide for 10% of DMG aqueous sampling sites) and total organic carbon samples (10% of DMG aqueous sampling sites) were shipped on October 7, 1996, 1430 hours.

Samples were shipped to:

Ground Water Samples (Inorganics)
Chemtech Consulting Group
110 Route 4
Englewood, New Jersey 07631

Organic Samples
American Technical & Analytical Services
875 Fee Road
Maryland Heights, Missouri 63043

Inorganic Samples
Southwest Labs of Oklahoma
1700 W. Albany, Suite C
Broken Arrow, Oklahoma

Total Organic Carbon
Acculabs Research
4663 Table Mountain Drive
Golden, Colorado 80403-1650

Following shipment of the inorganic samples to the laboratory, one jar containing sediments (specified for use as Lab QA/QC) had broken. Region VIII Regional Sample Control Center (RSCC) determined that the contents could be salvaged and analyzed, and an alternate sample would be used for Laboratory QA/QC.

A total of five ground water, eight surface water, fifty sediments, and fifteen source characterization samples were collected as specified in the Cement Creek Sample and Analysis Plan (CDPHE, 1996). Five ground water samples will be analyzed for Total and Dissolved Metals. Six aqueous samples (10 % of DMG surface water and CDPHE sediment samples) will be analyzed for Pesticides/Polychlorinated Biphenyls (PCBs), Base/Neutral/Acid Extractable Organics (BNAs), and Volatile Organics (VOA), Cyanide and Total Organic Carbon analyses. Six sediment samples collocated with the aqueous samples will also be analyzed for Pesticides/Polychlorinated Biphenyls (PCBs), Base/Neutral/Acid Extractable Organics (BNAs), Volatile Organics (VOA), Cyanide and Total Metals. The remaining 47 sediment samples, collocated with DMG's aqueous samples, will be analyzed for Total Metals. Fifteen mine dump source characterization samples will also be analyzed for Total Metals analyses.

A duplicate surface water sample, one field blank, one trip blank, and two equipment rinsate blanks (one for groundwater, one for sediments) were also collected for quality control samples. Tables I and II list the samples collected, the analyses requested, location, rationale, and field measurements.

All surface water, and ground water samples were collected directly into the sample containers to minimize the potential for cross-contamination and to minimize the necessity for decontamination of the sample collection equipment. A stainless steel spoon was used for collecting the sediments and source characterization (mine waste rock) samples from a depth of 0 to 6 inches. Sampling equipment was decontaminated in accordance with the Cement Creek Sample and Analysis Plan (CDPHE, 1996).

Sample locations were photographed (APPENDIX A), and field observations are detailed in Table I. Figures 1 through 5 depict the sample locations.

2.1 Surface Water and Sediments Samples

A total of fifty sediment samples were collected. The sediment samples, co-located with the surface water samples collected by DMG, are to be analyzed for Total Metals. Six of those sediment samples (representing approximately 10% of the total sediment samples collected) will also be analyzed for Pesticides/Polychlorinated Biphenyls (PCBs), Base/Neutral/Acid Extractable Organics (BNAs), Volatile Organics (VOA), and Cyanide.

Seven surface water samples (CC-SW-06, CC-SW-12, CC-SW-24, CC-SW-31, CC-SW-36, PG-SW-03, PG-SW-15) representing 10% of the total surface water samples collected by DMG, were collected to be analyzed for Pesticides/Polychlorinated Biphenyls (PCBs), Base/Neutral/Acid Extractable Organics (BNAs), and Volatile Organics (VOA), Cyanide and Total Organic Carbon analyses. (DMG will analyze aqueous samples for Total and Dissolved Metals).

One surface water and collocated sediment sample (CC-SW/SE-10) was collected to be analyzed for Total Metals, as it was not included in the DMG sample plan, but was necessary to determine the background water and sediment quality of the North Fork. Tables I and II provide the surface water and sediment sample descriptions; Figures 1-5 illustrate the sample site locations.

2.2 Groundwater Samples

Letters were mailed to Silverton-region well permittees listed on the February, 1996 Colorado Division of Water Resources Well data base asking if they would like their wells tested. Of seven letters sent, three were returned due to lack of forwarding addresses. Another person was later contacted by phone who indicated that her well was never completed. One permittee requested their well be tested.

An advertisement announcing the free and voluntary groundwater well sampling opportunity offered by the CDPHE and EPA was published in the *Silverton Standard* newspaper for five consecutive weeks (August 15 through September 12) prior to conducting the groundwater sampling activities. Four people contacted the CDPHE requesting their wells be tested.

On September 16 and 17, 1996, five groundwater samples (GW-1 through GW-5) were collected. GW-1 is located on Cement Creek, immediately downstream of Prospect Gulch. GW-2 was sampled from a residence in the South Fork of Cement Creek, which utilizes surface water from the Middle Fork of Cement Creek, below the Black Hawk mine. GW-3 is located adjacent to the mainstem of the Animas, above Howardsville, approximately 5 miles upstream of Silverton. GW-4 is a source of drinking water obtained from a draining mine (Leonard lode?) in Cunningham Gulch by vacationers during two weeks every year. GW-5 is located in Mineral Creek, above the North Star Mine, approximately one mile upstream of its confluence with the Animas River. Table I provides the well descriptions; Figures 1-5 illustrate the locations of the wells tested.

2.3 Source Characterization Samples

Fifteen samples were taken from source areas (mine waste rock piles) within the Cement Creek watershed site for characterization purposes. Samples collected for total metals analysis were collected between August 6 and 8, 1996. Tables I and II provide source area descriptions; Figures 1-5 illustrate sample site locations.

2.4 Quality Control Samples

An increased volume was taken of the water sample at CC-SW-06 for laboratory quality control purposes. Three times the normal volume of water was taken for BNA and Pesticide/PCB, and VOA analyses; double the normal volume was collected for cyanide analyses.

Sample CC-SW-36 was collected as a duplicate of CC-SW-06. No duplicates were taken for sediments due to the inherent heterogeneities associated with those media.

One trip blank, CC-SW-39 was submitted for VOA analysis only, one per cooler (shipment) containing samples for volatile organic analysis. One field blank, CC-SW-37, was collected. The field blank was collected to assess field conditions at the time of sampling. It was submitted for Pesticide/PCB, BNA, VOA, and Cyanide analyses. One equipment rinsate blank, CC-SW-38, was collected following the collection of GW-1 through GW-5 to assess the effectiveness of the decontamination procedures of the filtering apparatus. Another equipment rinsate blank, CC-SW-40 was collected from the stainless steel spoons used for collecting sediments following decontamination.

3.0 <u>DEVIATIONS FROM THE SAMPLE PLAN</u>

The Sample plan anticipated the analysis of seven groundwater wells listed in the State Engineers Office Well data base; in actuality, one of those seven were sampled. The sampling of the other four sources of drinking water resulted from response to the newspaper advertisement. One of the five sources of drinking water tested emanated from a collapsed draining mine (GW-4); another was taken directly from surface water of the Middle Fork, below the Black Hawk mine (GW-2). The samples were collected in accordance with the approved sample plan.

To coordinate with the DMG Sample Plan, additional changes were made; the following Table outlines deviations from the Sampling Plan:

Sample Number:	Deviation:	From:	To:
GW-1	location changed	1 mile upstream of American Tunnel on South Fork	Cement Creek approximately 1 mile downstream of confluence with Prospect Gulch.
GW-2	source changed	ground water well	Surface water form the Middle Fork of Cement Creek, below the Black Hawk Mine.
GW-3	owner name changed	Powell	Padrick
GW-4	location and source changed	ground water well 2.5 miles upstream of Silverton on the Animas River	Draining mine adit (Leonard lode?) in Cunningham Gulch, approximately 1 mile below the Pride of the West Mine.
GW-5	location changed	0.5 miles upstream of Silverton on the Animas River	Mineral Creek, 1 mile above its confluence with Animas River.
GW-6	deleted		
GW-7	deleted		
OP-SO-01	source sample added		Upper Gold King Mine waste rock.
OP-SO-02	source sample added		Silver Ledge Mine waste rock.
CC-SO-17	sample number changed	CC-SO-17	CC-SO-25
CC-SE-14	NOT SAMPLED - DRY		
CC-SE-27	location changed	Cement Cr. above Ohio Gulch	Georgia G. above confluence with Cement Cr.
CC-SE-28	location changed	Ohio G. above Cement Cr.	Cement Cr. below Georgia G.
CC-SE-29	location changed	Cement Cr. below Ohio G.	Cement Cr. above Porcupine G.
CC-SE-30	location changed	Cement Cr. below the Gold Hub Mine	Porcupine G. above Cement Cr.
CC-SE-32	sample number changed	CC-SE-32	CC-SE-CC-48
CC-SE-33	sample number changed	CC-SE-33	CC-SE-A-68
CC-SE-34	sample number changed	CC-SE-34	CC-SE-M-34
CC-SE-35	sample number changed	CC-SE-35	CC-SE-A-72
CC-SE-32 (new)	add location NOT SAMPLED - DRY		Tributary of Cement Creek above the Queen Anne Mine and below a series of Waste Rock Piles
CC-SE-33 (new)	add location		Cement Creek below Gladstone, above the confluence with South Fork to assess treatment of Cement Creek by Sunnyside Gold Corp.
PG-SE-12 PG-SE-13	change description in Table 1 NOT SAMPLED - DRY	points relative to the "Lark Mine"	points relative to the "Henrietta 7 Mine Complex"
PG-SE-14 PG-SE-15 PG-SE-16	change description in Table 1	points relative to the "Lark Mine"	points relative to the "Henrietta 7 Mine Complex"
PG-SE-17	NOT SAMPLED - DRY		
PG-SE-20	add location NOT SAMPLED - DRY		Tributary above the Hercules Mine, below the unknown mine with waste rock in channel.

+ CC-SW-10 ADD location (N. Fork above Gold King Mine) →

Needs label

4.0 REFERENCES

Colorado Department of Public Health and Environment, Hazardous Materials and Waste Management Division. *Sample and Analysis Plan: Cement Creek Watershed.* July, 1996.

Colorado Division of Minerals and Geology, Inactive Mine Program, 1996. Telephone conversations and personal meetings with Jim Herron. July, August, September.

TABLE I: SAMPLING ACTIVITIES SUMMARY
Cement Creek Watershed
Page of

Sample	Location	Rationale	Date & Time Sample Taken	Analysis M=Metals C=Cyanide TOC = Total Organic Carbon B=BNA P=PCB/Pest V=VOA	Organic CLP Sample Number	Inorganic CLP Sample Number	EC (mS)	Temp (°C)	pH	Comments
GW-1	Residential ground water well located approximately 1 mile downstream of Prospect Gulch on Cement Creek.	To determine alluvial ground water quality of drinking water wells in Cement Creek.	09/16/96, 0945	M	N/A	MHDB 16	568	8.0	5.47	Sample taken from pump-house at the Legge residence, prior to in home filtering. Water level was approximately 6 feet below the ground surface. The "well" is constructed from a galvanized culvert placed vertically into the ground approximately 10 feet below the ground surface, rising to approximately 4 feet above the ground surface. Four people reside at this location during summer months.
GW-2	Residential use of surface water from the Middle Fork of Cement Creek, below the Black Hawk mine.	To determine drinking water quality of Williamson residence.	09/16/96, 1030	M	N/A	MHDB 17	535	8.2	6.73	Sample taken from kitchen sink inside the Williamson house. One person resides at this location during summer months.
GW-3	Industrial Park/residence ground water well located approximately 1 mile upstream of Howardsville on the Animas River.	To determine ground water quality in drinking water wells along the Animas River.	09/16/96, 1325	M	N/A	MHDB 18	1406	9.2	7.07	Sample taken from garden hose attached to pump at the Industrial Park. The water flowed for 10 minutes prior to sampling. Water was somewhat rusty and sandy. Had not been used for some time. No one currently works or resides at this location. Well is constructed with perforated steel pipe to a depth of 70 feet. Owner related that water level ranges from 18 to 23 feet below the ground surface.
GW-4	Draining mine adit (Leonard lode?) used for drinking water in Cunningham Gulch, approximately 1 mile below the Pride of the West Mine.	To determine drinking water quality at the "Strange" family vacation site.	09/16/96, 1450	M	N/A	MHDB 19	35	6.8	6.33	Sample collected from draining mine flow path emanating from a collapsed adit. Mr. and Mrs. E.C. Strange park their camper at this location fro two weeks each summer. Water is filtered prior to drinking.

1800733

TABLE I: SAMPLING ACTIVITIES SUMMARY
Cement Creek Watershed
Page of

Sample	Location	Rationale	Date & Time Sample Taken	Analysis M=Metals C=Cyanide TOC = Total Organic Carbon B=BNA P=PCB/Pest V=VOA	Organic CLP Sample Number	Inorganic CLP Sample Number	EC (mS)	Temp (°C)	pH	Comments
GW-5	Residential Ground Water well located on the east bank of Mineral Creek, approximately 1 mile upstream of its confluence with the Animas River.	To determine ground water quality in Mineral Creek.	09/17/96, 1030	M	N/A	MHDB 85	159	9.2	5.3	Sample was taken from an excavation with exposed ground water immediately adjacent to the well. The well is associated with an auto mechanic shop; however, it is not connected to the plumbing system. The well is constructed of metal casing to a depth of 35 feet. The water level was measured at 4 feet below the ground surface.
CC-SW-38	Equipment rinsate blank for filtration apparatus to obtain dissolved metal fraction of ground water well samples.	To assess the effectiveness of the decontamination procedures of the filtering apparatus.	09/16/96, 1616	M	N/A	MHDB 82	-	-	-	Sample was taken by collecting distilled water rinsate from the filtering apparatus following decontamination procedures.

ED_000552_00029910-00110

TABLE I: SAMPLING ACTIVITIES SUMMARY
Cement Creek Watershed
Page of

Sample	Location	Rationale	Date & Time Sample Taken	Analysis M=Metals C=Cyanide TOC = Total Organic Carbon B=BNA P=PCB/Pest V=VOA	Organic CLP Sample Number	Inorganic CLP Sample Number	EC (mS)	Temp (°C)	pH	Comments
CC-SE-1	Cement Creek upstream of the Queen Anne Mine.	To determine background sediment quality for Cement Creek.	10/01/96, 1405	M	N/A	MHDB 20	-	-	-	
CC-SE-2	Cement Creek below the discharge from the Queen Anne Mine drainage and waste rock pile.	To assess potential contribution of substances from the Queen Anne Mine (SO-1) and waste pile (SO-2).	10/01/96, 1345	M	N/A	MHDB 21	-	-	-	
CC-SE-3	Ross Basin tributary (Upper Cement Creek) upstream of the unnamed draining mine and waste pile.	To determine background sediment quality for Cement Creek.	10/01/96, 1215	M	N/A	MHDB 22	-	-	-	
CC-SE-4	Ross Basin tributary downstream of the Unnamed draining Mine and waste pile.	To assess potential contribution of substances from the Ross Basin unnamed draining mine (SO-3) and waste pile (SO-4).	10/01/96, 1130	M	N/A	MHDB 23	-	-	-	
CC-SE-5	Cement Creek upstream of the Mogul and South Mogul Mine drainages and waste piles.	To determine ambient sediment quality in Cement Creek upstream of the Mogul and South Mogul Mines.	10/01/96, 1030	M	N/A	MHDB 24	-	-	-	
CC-SE-6	Cement Creek downstream of the Mogul and South Mogul Mine drainages and waste piles.	To assess potential contribution of substances from the Mogul (SO-5) and South Mogul (SO-6) Mine drainages and Mine waste piles (SO-7) to Cement Creek at the probable point of entry.	10/01/96,1015	M,C,TOC,B,P,V	HR 666	MHDB 25	-	-	-	

TABLE I: SAMPLING ACTIVITIES SUMMARY
Cement Creek Watershed
Page of

Sample	Location	Rationale	Date & Time Sample Taken	Analysis M=Metals C=Cyanide TOC = Total Organic Carbon B=BNA P=PCB/Pest V=VOA	Organic CLP Sample Number	Inorganic CLP Sample Number	EC (mS)	Temp (°C)	pH	Comments
CC-SE-7	Cement Creek above Corkscrew Gulch, above small denuded area.	To determine sediment quality in Cement Creek prior to contribution of the small denuded area.	10/01/96, 0845	M	N/A	MHDB 26	-	-	-	
CC-SE-8	Cement Creek below the confluence of Corkscrew Gulch and the small denuded area and above the Red & Bonita Mine.	To determine sediment quality in Cement Creek below the small denuded area, and upstream of the Red & Bonita Mine.	10/01/96, 1130	M	N/A	MHDB 27	-	-	-	
CC-SE-9	Cement Creek below the Red & Bonita Mine drainage and waste pile.	To assess potential contribution of substances from the Red & Bonita Mine drainage (SO-8) and waste pile (SO-9).	09/30/96, 1508	M	N/A	MHDB 28	-	-	-	
CC-SE-10	North Fork above the Gold King Mine complex.	To determine background sediment quality in the North Fork.	09/30/96, 1540	M	N/A	MHDB 29	-	-	-	
CC-SE-12	North Fork below the Gold King Mine complex.	To assess potential contribution of substances from the Gold King Mine complex to the North Fork.	09/30/96, 1502	M,C,TOC,B,P,V	HR 667	MHDB 30	-	-	-	
CC-SE-13	Cement Creek below the confluence with North Fork, above the confluence with South Fork.	To determine sediment quality in Cement Creek Miguel below its confluence with North Fork.	09/30/96, 1455	M	N/A	MHDB 31	-	-	-	

TABLE I: SAMPLING ACTIVITIES SUMMARY
Cement Creek Watershed
Page of

Sample	Location	Rationale	Date & Time Sample Taken	Analysis M=Metals C=Cyanide TOC = Total Organic Carbon B=BNA P=PCB/Pest V=VOA	Organic CLP Sample Number	Inorganic CLP Sample Number	EC (mS)	Temp (°C)	pH	Comments
CC-SE-14	Minnehaha Creek above the Lead Carbonate Mill waste pile.	To determine background sediment quality in Minnehaha Creek.	NOT SAMPLED - DRY							
CC-SE-15	Minnehaha Creek below the Lead Carbonate Mill waste pile.	To assess potential contribution of substances from the Lead Carbonate Mill waste pile (SO-10) to Minnehaha Creek.	10/01/96, 1620	M	N/A	MHDB 33	-	-	-	
CC-SE-16	Minnehaha Creek above its confluence with South Fork.	To determine sediment quality in Minnehaha Creek prior to its confluence with South Fork.	10/01/96, 0920	M	N/A	MHDB 34	-	-	-	
CC-SE-17	Middle Fork above the unnamed instream waste pile.	To determine background sediment quality in the Middle Fork.	10/01/96, 1610	M	N/A	MHDB 35	-	-	-	
CC-SE-18	Middle Fork below the unnamed instream waste pile.	To assess potential contribution of substances from the unnamed instream waste pile (SO-11) to Middle Fork at the probable point of entry.	10/01/96, 1600	M	N/A	MHDB 36	-	-	-	
CC-SE-19	Middle Fork below the Black Hawk Mine drainage and waste pile.	To assess potential contribution of substances from the Black Hawk mine drainage (SO-12) and waste pile to the Middle Fork.	10/01/96, 1545	M	N/A	MHDB 37	-	-	-	

1800733

TABLE I: SAMPLING ACTIVITIES SUMMARY
Cement Creek Watershed
Page of

Sample	Location	Rationale	Date & Time Sample Taken	Analysis M=Metals C=Cyanide TOC = Total Organic Carbon B=BNA P=PCB/Pest V=VOA	Organic CLP Sample Number	Inorganic CLP Sample Number	EC (mS)	Temp (°C)	pH	Comments
CC-SE-20	Middle Fork above its confluence with South Fork.	To determine sediment quality in the Middle Fork below combined mine waste sources.	10/01/96, 1435	M	N/A	MHDB 38	-	-	-	
CC-SE-21	South Fork above the Silver Ledge Mine drainage and waste pile.	To determine background sediment quality of the South Fork.	10/01/96, 1215	M	N/A	MHDB 39	-	-	-	
CC-SE-22	South Fork below the Silver Ledge Mine drainage and waste pile.	To assess potential contribution of substances forrn the Silver Ledge mine drainage (SO-13) and waste pile to South Fork at the probable point of entry.	10/01/96, 1110	M	N/A	MHDB 40	-	-	-	
CC-SE-23	South Fork above its confluence with Cement Creek.	To assess potential contributions of substances form South Fork to Cement Creek.	09/30/96, 1427	M	N/A	MHDB 41	-	-	-	
CC-SE-24	Cement Creek below the confluence with South Fork.	To determine sediment quality in Cement Creek below the confluence with South Fork.	09/30/96, 1420	M,C,TOC,B,P,V	HR 668	MHDB 42	-	-	-	
CC-SE-25	Cement Creek above its confluence with Prospect Gulch.	To determine sediment quality of Cement Creek above its confluence with Prospect Gulch.	09/30/96, 1405	M	N/A	MHDB 43	-	-	-	

1800733

TABLE I: SAMPLING ACTIVITIES SUMMARY
Cement Creek Watershed
Page of

Sample	Location	Rationale	Date & Time Sample Taken	Analysis M=Metals C=Cyanide TOC = Total Organic Carbon B=BNA P=PCB/Pest V=VOA	Organic CLP Sample Number	Inorganic CLP Sample Number	EC (mS)	Temp (°C)	pH	Comments
CC-SE-26	Cement Creek below its confluence with Prospect Gulch.	To determine sediment quality of Cement Creek below its confluence with Prospect Gulch.	09/30/96, 1415	M	N/A	MHDB 44	-	-	-	
CC-SE-27	Cement Creek above its confluence with Ohio Gulch.	To determine sediment quality of Cement Creek above its confluence with Ohio Gulch.	09/30/96, 1341	M	N/A	MHDB 45	-	-	-	
CC-SE-28	Ohio Gulch above its confluence with Cement Creek.	To assess potential contribution of substances from Ohio Gulch to Cement Creek.	09/30/96, 1258	M	N/A	MHDB 46	-	-	-	
C-SE-29	Cement Creek below its confluence with Ohio Gulch, above the Gold Hub Mine.	To determine sediment quality of Cement Creek below its confluence with Ohio Gulch.	09/30/96, 1216	M	N/A	MHDB 47	-	-	-	
CC-SE-30	Cement Creek below the Gold Hub Mine, above the Anglo Saxon Mine.	To assess potential contribution of substances from the Gold Hub Mine drainage (SO-14) and waste pile (SO-15) to Cement Creek at the probable point of entry.	09/30/96, 1200	M	N/A	MHDB 48	-	-	-	

ED_000552_00029910-00115

TABLE I: SAMPLING ACTIVITIES SUMMARY
Cement Creek Watershed

Sample	Location	Rationale	Date & Time Sample Taken	Analysis M=Metals C=Cyanide TOC = Total Organic Carbon B=BNA P=PCB/Pest V=VOA	Organic CLP Sample Number	Inorganic CLP Sample Number	EC (mS)	Temp (°C)	pH	Comments
CC-SE-31	Cement Creek below the Anglo Saxon Mine drainage and waste pile.	To assess potential contribution of substances from the Anglo Saxon Mine drainage (SO-16) and waste pile (SO-25) to Cement Creek at the probable point of entry.	09/30/96, 1207	M,C,TOC,B,P,V	HR 669	MHDB 49	-	-	-	
CC-SE-33	Cement Creek below Gladstone, above the confluence with South Fork.	To determine sediment quality in Cement Creek above the confluence with South Fork.	09/30/96, 1437	M	N/A	MHDB 51	-	-	-	
CC-SE-CC-48	Cement Creek above its confluence with the Animas River.	To determine sediment quality of Cement Creek above its confluence with the Animas River.	10/02/96, 1120	M	N/A	MHDB 52	-	-	-	
CC-SE-A-68	Animas River above the confluence with Cement Creek.	To determine sediment quality of the Animas River above its confluence with Cement Creek.	10/02/96, 1107	M	N/A	MHDB 53	-	-	-	
CC-SE-M-34	Mineral Creek above confluence with the Animas River.	To determine ambient sediment quality in Mineral Creek.	10/02/96, 1050	M	N/A	MHDB 54	-	-	-	
CC-SE-A-72	Animas River below the confluence of Mineral Creek.	To assess potential contribution of substances from Mineral Creek to the Animas River at a point below their confluence.	10/02/96, 1035	M	N/A	MHDB 55	-	-	-	

TABLE I: SAMPLING ACTIVITIES SUMMARY
Cement Creek Watershed
Page of

Sample	**Location**	**Rationale**	**Date & Time Sample Taken**	**Analysis** M=Metals C=Cyanide TOC = Total Organic Carbon B=BNA P=PCB/Pest V=VOA	**Organic CLP Sample Number**	**Inorganic CLP Sample Number**	**EC (mS)**	**Temp (°C)**	**pH**	**Comments**
CC-SW-6	Cement Creek downstream of the Mogul and South Mogul Mines.	To assess potential contribution of organic substances from the Mogul and South Mogul Mines.	10/01/96, 1233	C,TOC,B,P,V	HR 672	MHDB 76	225		3.83	
CC-SW-12	North Fork downstream of the Gold King Mine Complex.	To assess potential contribution of organic substances from the Gold Kink Mine Complex.	10/01/96, 1113	C,TOC,B,P,V	HR 673	MHDB 77	2090		2.66	
CC-SW-24	Cement Creek below the confluence with South Fork.	To assess potential contribution of organic substances from the Sunnyside Mine.	10/01/96, 1035	C,TOC,B,P,V	HR 674	MHDB 78	1227		6.11	
CC-SW-31	Cement Creek downstream of Porcupine Gulch.	To assess potential contribution of organic substances from Porcupine Gulch.	10/01/96, 0905	C,TOC,B,P,V	HR 675	MHDB 79	820		3.76	
+ CC SW-10	North Fork above Gold King Mine Complex	TO assess background contribution of metals to the North Fork	9/30/96, 1540	M	N/A	MHDB 80				

TABLE I: SAMPLING ACTIVITIES SUMMARY
Cement Creek Watershed
Page of

Sample	Location	Rationale	Date & Time Sample Taken	Analysis M=Metals C=Cyanide TOC = Total Organic Carbon B=BNA P=PCB/Pest V=VOA	Organic CLP Sample Number	Inorganic CLP Sample Number	EC (mS)	Temp (°C)	pH	Comments
CC-SO-2	Queen Anne Mine waste pile.	**Source characterization.**	08/07/96, 1645	M	N/A	MHDB 01	-	-	-	
CC-SO-4	Ross Basin Unnamed Mine waste pile.		08/07/96, 1530	M	N/A	MHDB 02	-	-	-	
CC-SO-6	Mogul Mine waste pile.		08/07/96, 1500	M	N/A	MHDB 03	-	-	-	
CC-SO-9	Red & Bonita Mine waste pile.		08/07/96, 1415	M	N/A	MHDB 04	-	-	-	
CC-SO-10	Lead Carbonate Mill waste pile.		08/07/96, 1155	M	N/A	MHDB 05	-	-	-	
CC-SO-11	Middle Fork unnamed instream waste pile.		08/07/96, 1215	M	N/A	MHDB 06	-	-	-	
CC-SO-15	Gold Hub Mine waste pile.		08/07/96, 0825	M	N/A	MHDB 07	-	-	-	
CC-SO-25	Anglo Saxon Mine waste pile.		08/08/96, 0830	M	N/A	MHDB 08	-	-	-	
OP-SO-01	Upper Gold King Mine waste pile.		08/07/96, 1115	M	N/A	MHDB 09	-	-	-	
OP-SO-02	Silver Ledge Mine waste pile.		08/07/96, 1330	M	N/A	MHDB 10	-	-	-	

TABLE I: SAMPLING ACTIVITIES SUMMARY
Cement Creek Watershed
Page of

Sample	Location	Rationale	Date & Time Sample Taken	Analysis M=Metals C=Cyanide TOC = Total Organic Carbon B=BNA P=PCB/Pest V=VOA	Organic CLP Sample Number	Inorganic CLP Sample Number	EC (mS)	Temp (°C)	pH	Comments
CC-SW-36	Duplicate of SW-6	Quality control sample to assess accuracy and precision.	10/01/96, 1233	C,TOC,B,P,V	HR 676	MHDB 80	-	-	-	
CC-SW-37	Field blank for Day 1 sampling.	Quality control sample to assess potential field contamination.	10/02/96, 0830	C,TOC,B,P,V	HR 677	MHDB 81	-	-	-	
CC-SW-39	Trip Blank for volatile organics sampling.	Quality control to assess sample handling/shipping procedures.	10/02/96, 0845	V	HR 679	N/A	-	-	-	
CC-SW-40	Rinsate Blank for sediment sampling.	Quality control to assess field decontamination procedures.	10/02/96, 1012	M,C,B,P,V	HR 678	MHDB 87	-	_	-	

TABLE II: SAMPLING ACTIVITIES SUMMARY
Cement Creek Watershed - Prospect Gulch
Page of

Sample	**Location**	**Rationale**	Date & Time Sample Taken	Analysis M=Metals C=Cyanide TOC = Total Organic Carbon B=BNA P=PCB/Pest V=VOA	Organic CLP Sample Number	Inorganic CLP Sample Number	EC (mS)	Temp (°C)	pH	
PG-SE-1	Prospect Gulch upstream of the Galena Queen Mine waste pile.	To determine background sediment quality for Prospect Gulch.	10/01/96, 1401	M	N/A	MHDB 56	-	-	-	
PG-SE-2	Prospect Gulch upstream of the Galena Queen Mine waste pile.	To determine background sediment quality for Prospect Gulch.	10/01/96, 1351	M	N/A	MHDB 57	-	-	-	
PG-SE-3	Prospect Gulch below the Galena Queen Mine.	To assess potential contribution of substances from the Galena Queen Mine waste (SO-1) at the probable point of entry.	10/01/96, 1321	M	N/A	MHDB 58	-	-	-	
PG-SE-4	Tributary to Prospect Gulch.	To determine background sediment contributions to Prospect Gulch.	10/01/96, 1326	M,C,TOC,B,P,V	HR 670	MHDB 59	-	-	-	
PG-SE-5	Tributary with Acid Rock Drainage.	To assess potential contribution of substances from the tributary with ARD to Prospect Gulch.	10/01/96, 1246	M	N/A	MHDB 60	-	-	-	
PG-SE-6	Tributary with Hercules Mine waste located therein.	To assess potential contribution of substances from the Hercules Mine waste pile (SO-2) to Prospect Gulch.	10/01/96, 1240	M	N/A	MHDB 61	-	-	-	
PG-SE-7	Tributary with Acid Rock Drainage.	To assess potential contribution of substances from the tributary with ARD to Prospect Gulch.	10/01/96, 1230	M	N/A	MHDB 62	-	-	-	
PG-SE-8	Prospect Gulch below tributaries with mine waste and ARD.	To assess potential contribution of substances from upper basin mine workings.	10/01/96, 1213	M	N/A	MHDB 63	-	-	-	
PG-SE-9	Prospect Gulch below "mineralized canyon" and above the Henrietta Mine.	To assess potential contribution of substances from the Mineralized canyon and to determine ambient sediment quality in Prospect Gulch above the Henrietta Mine (SO-3).	10/01/96, 1120	M	N/A	MHDB 64	-	-	-	
PG-SE-10	Mineralized Tributary above the Henrietta (level 7) Mine complex.	To assess potential contribution of a naturally mineralized canyon to Prospect Gulch.	10/01/96, 1059	M	N/A	MHDB 65	-	-	-	

TABLE II: SAMPLING ACTIVITIES SUMMARY
Cement Creek Watershed - Prospect Gulch
Page of

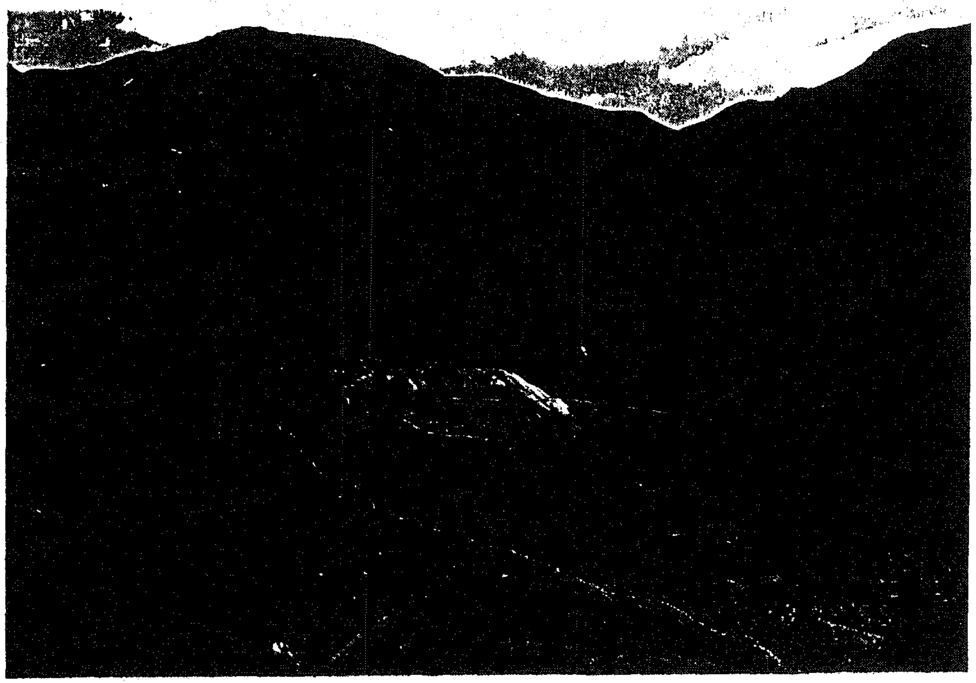
~~Appears in next Table~~

Sample	Location	Rationale	Date & Time Sample Taken	Analysis M=Metals C=Cyanide TOC = Total Organic Carbon B=BNA P=PCB/Pest V=VOA	Organic CLP Sample Number	Inorganic CLP Sample Number	EC (mS)	Temp (°C)	pH	
PG-SE-11	Prospect Gulch above the Henrietta Mine Complex.	To determine sediment quality in Prospect Gulch upstream of the Henrietta Mine drainage (SO-3) and waste pile (SO-4).	10/01/96, 1052	M	N/A	MHDB 66	-	-	-	
PG-SE-12	Perennial Springs upstream of the Lark Mine waste pile.	To assess potential contribution of substances from naturally occurring springs to Prospect Gulch.	NOT SAMPLED - DRY							
PG-SE-13	Springs on top of the Lark Mine waste pile.	To determine quality of spring water prior to its infiltrating the Lark Mine Waste pile (SO-5).	NOT SAMPLED - DRY							
PG-SE-14	Springs after percolating through the Lark Mine waste Pile.	To assess potential contribution of substances from the Lark Mine waste pile to springs flowing into Prospect Gulch.	10/01/96, 1037	M	N/A	MHDB 69	-	-	-	? NOT TAKEN
PG-SE-15	Prospect Gulch below the Henrietta Mine complex, above the probable point of entry of the Lark Mine waste pile springs.	To determine sediment quality in Prospect Gulch downstream of the Henrietta Mine complex.	10/01/96, 1034	M	N/A	MHDB 70	-	-	-	
PG-SE-16	Prospect Gulch below the Lark Mine waste pile springs.	To determine sediment quality in Prospect Gulch below the probable point of entry of the Lark Mine waste pile springs.	10/01/96, 0952	M,C,TOC,B,P,V	HR 671	MHDB 71	-	-	-	
PG-SE-17	Tributaries from the Upper Joe and Johns Mine.	To assess potential contribution of substances from the Upper Joe and Johns Mine to Prospect Gulch at the probable point of entry.	NOT SAMPLED - DRY							
PG-SE-18	Prospect Gulch below Joe and John's mine.	To assess the potential contribution of substances from Joe and John's Mine drainage and waste pile to Prospect Gulch.	10/01/96, 0929	M	N/A	MHDB 73	-	-	-	
PG-SE-19	Prospect Gulch above confluence with Cement Creek.	To determine sediment quality in Prospect Gulch below combined mine waste sources before its confluence with Cement Creek.	10/01/96, 1444	M	N/A	MHDB 74	-	-	-	

TABLE II: SAMPLING ACTIVITIES SUMMARY
Cement Creek Watershed - Prospect Gulch
Page of

Sample	Location	Rationale	Date & Time Sample Taken	Analysis M=Metals C=Cyanide TOC = Total Organic Carbon B=BNA P=PCB/Pest V=VOA	Organic CLP Sample Number	Inorganic CLP Sample Number	EC (mS)	Temp (°C)	pH	
PG-SW-3	Prospect Gulch below Galena Queen Mine.	To assess potential contribution of organic substances to Prospect Gulch from the Galena Queen Mine waste pile.	10/01/96, 1440	M,C,TOC,B,P,V	HR 680	MHDB 83	1073		2.73	
PG-SW-15	Prospect Gulch below the Lark Mine waste pile springs.	To assess potential contribution of organic substances to Prospect Gulch from the Lark Mine waste pile.	10/01/96, 1400	M,C,TOC,B,P,V	HR 681	MHDB 84				
PG-SO-1	Galena Queen Mine waste pile	Source characterization.	08/06,96, 1300	M	N/A	MHDB 11	-	-	-	
PG-SO-2	Hercules Mine waste pile.	Source characterization.	08/06/96, 1315	M	N/A	MHDB 12	-	-	-	
PG-SO-13	Henrietta (level 7) Mine waste pile.	Source characterization.	08/06/96, 1000	M	N/A	MHDB 13	-	-	-	
PG-SO-5	Lark Mine waste pile.	Source characterization.	08/06/96, 0915	M	N/A	MHDB 14	-	-	-	
PG-SO-7	Joe and John's Mine waste pile.	Source characterization.	08/06/96, 1045	M	N/A	MHDB 15	-	-	-	

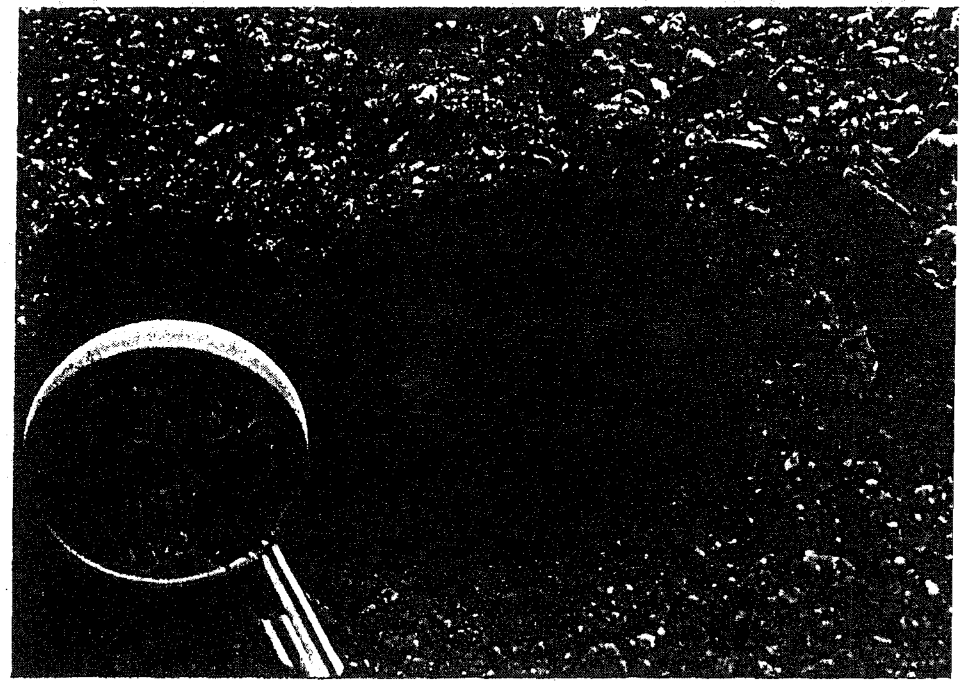
OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION



Description of Photo: CC-SO-06 Mogul Mine waste pile.

Date: August 12, 1996

Direction facing: Northeast (35mm film)

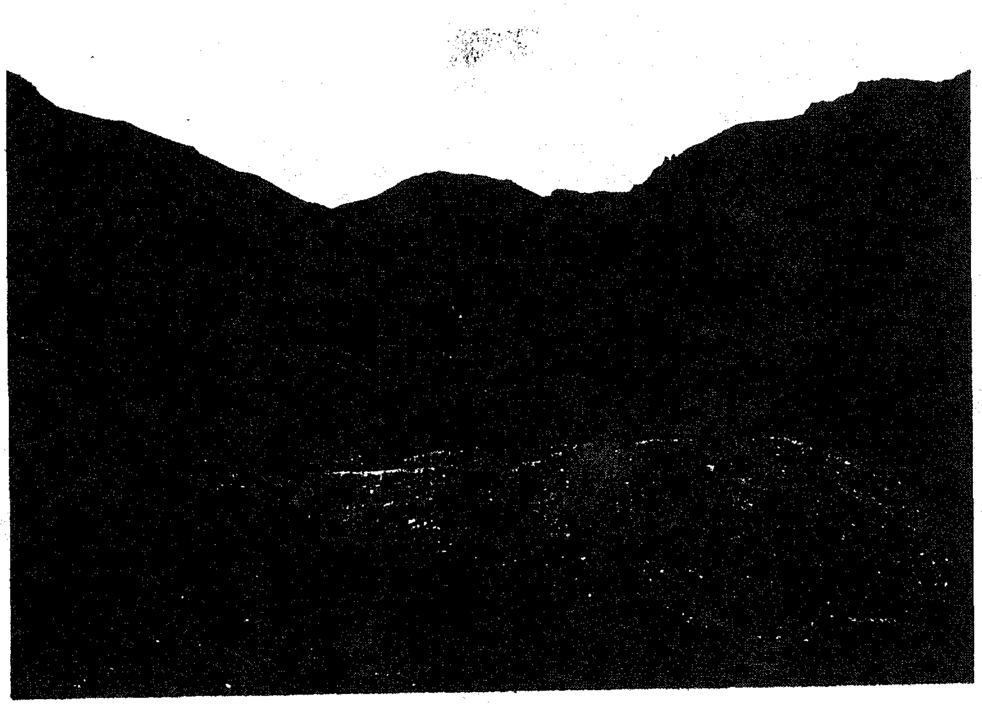


Description of photo: CC-SO-06 Mogul Mine waste rock pile (closeup).

Date: August 12, 1996

Direction facing: Northeast (35 mm film)

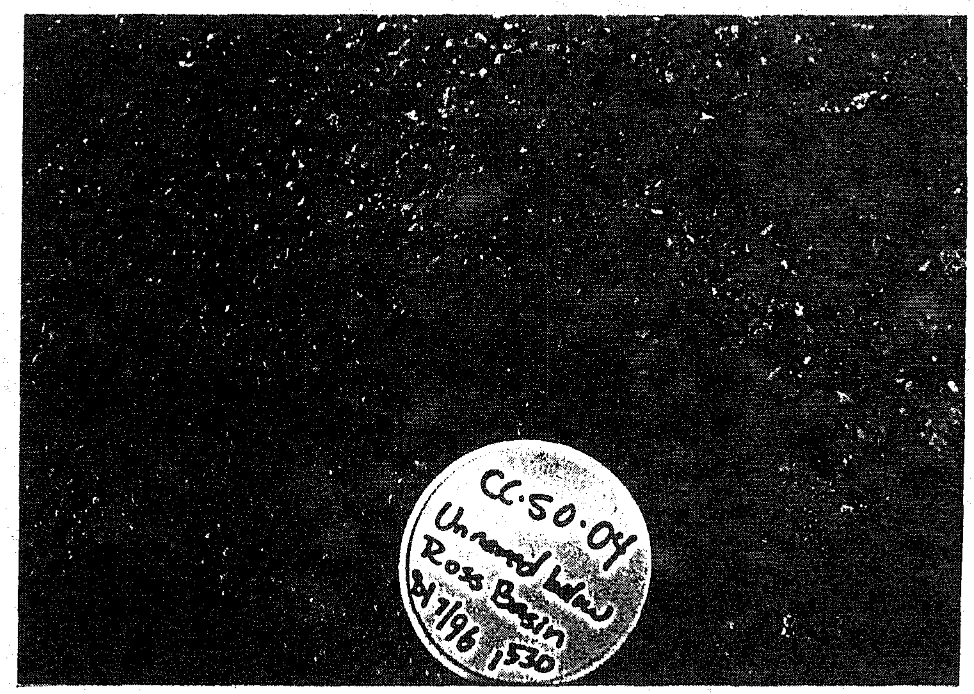
OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION



Description of Photo: CC-SO-04 Unnamed Mine below Ross Basin (background).

Date: August 7, 1996

Direction facing: East (35mm film)

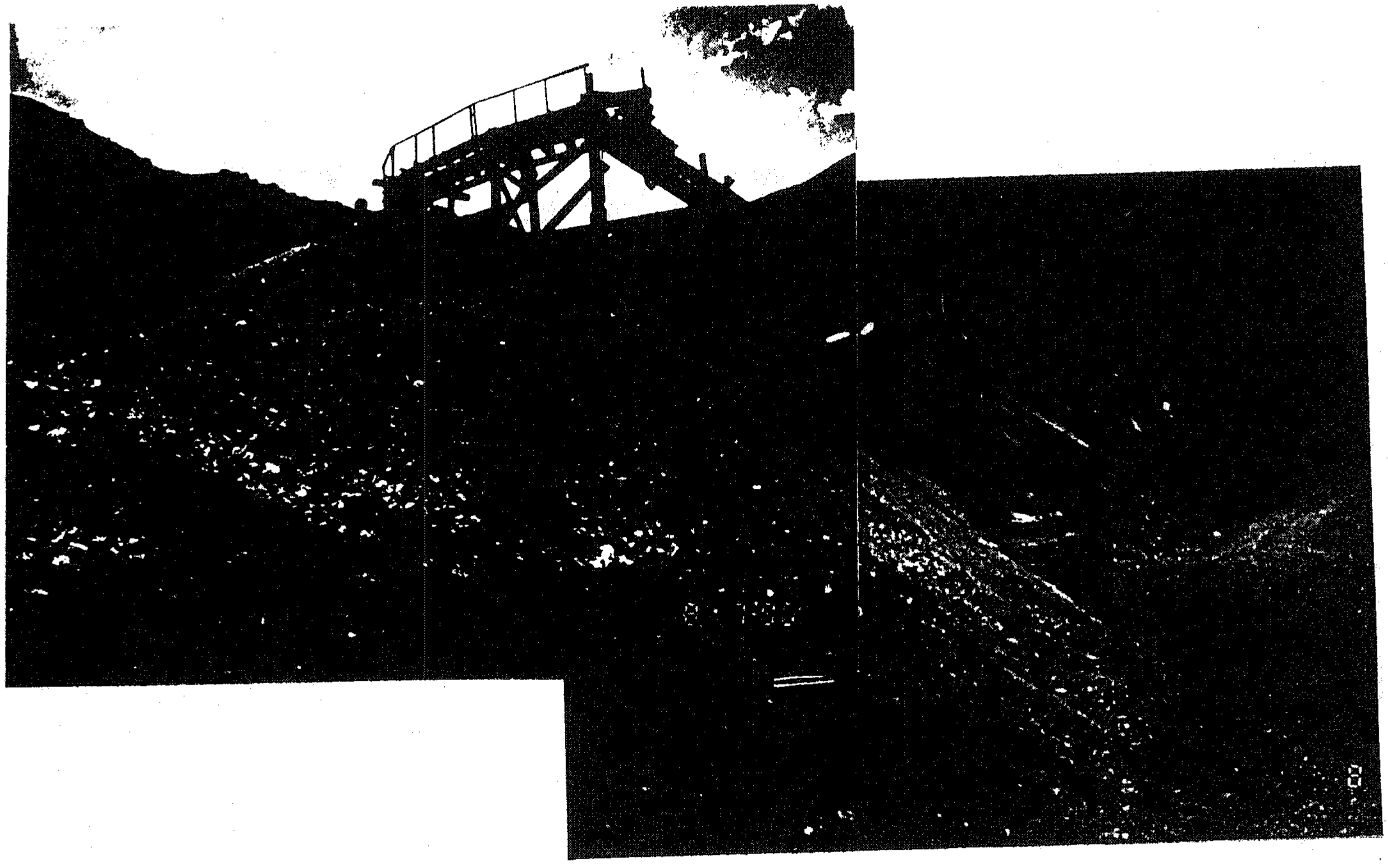


Description of Photo: CC-SO-04 Unnamed Mine below Ross Basin waste rock pile (closeup).

Date: August 7, 1996

Direction facing: East (35mm film)

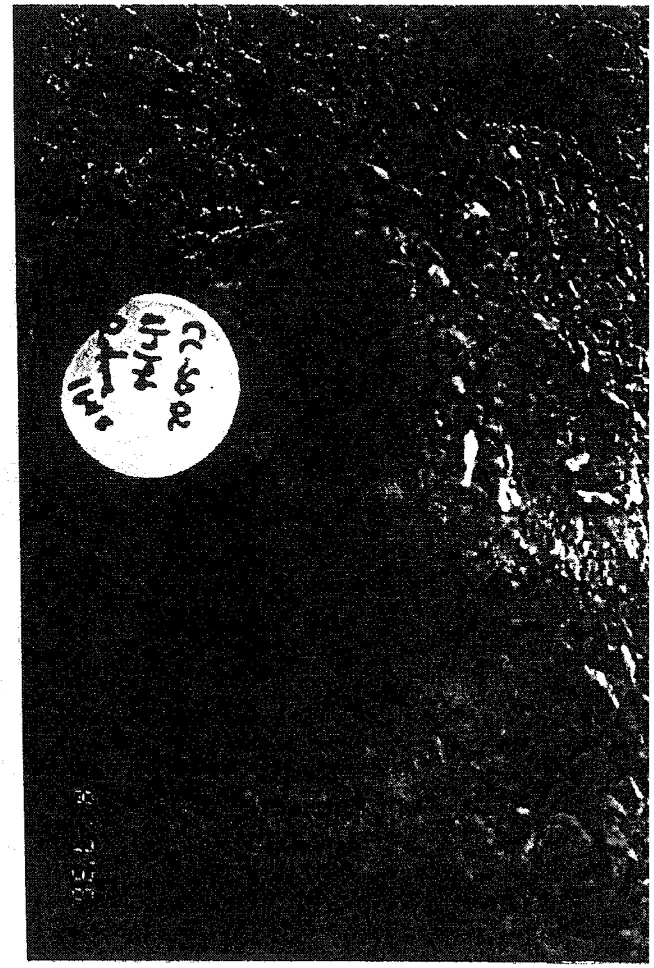
OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION



Description of Photo: CC-SO-02 Queen Anne Mine waste pile.

Date: August 7, 1996

Direction facing: East (35mm film)

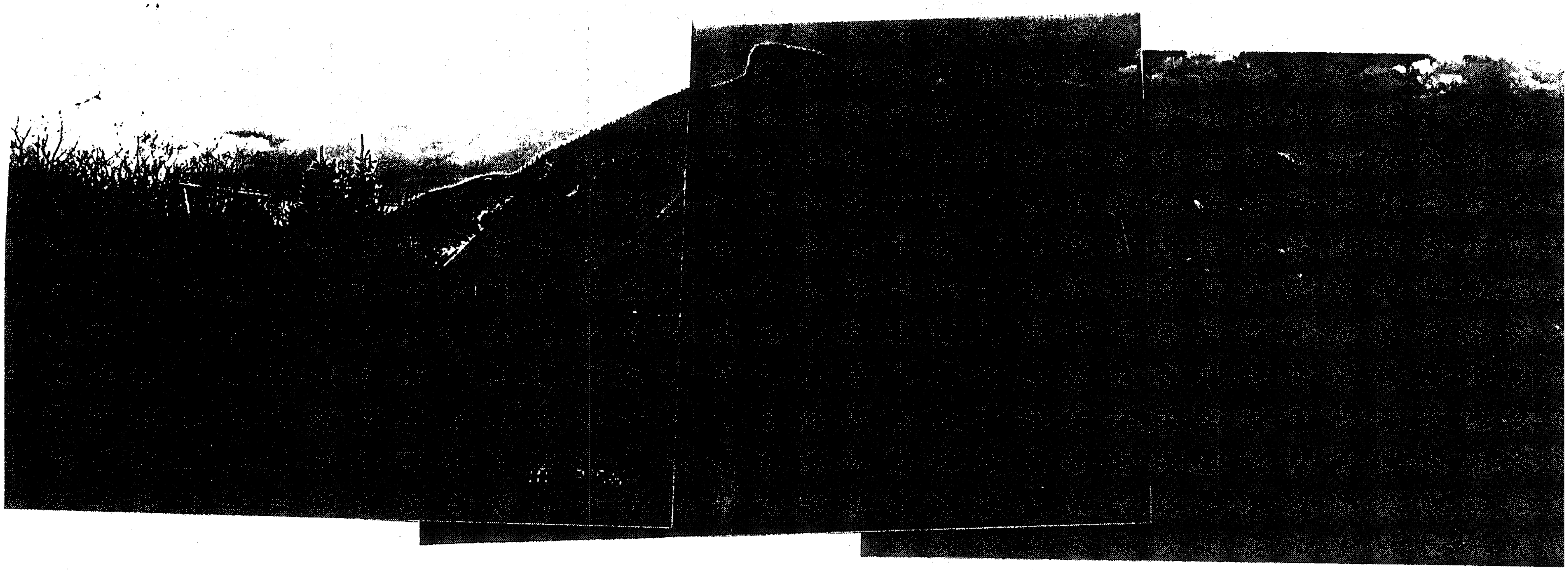


Description of Photo: CC-SO-02 Queen Anne Mine Waste (closeup).

Date: August 7, 1996

Direction facing: East (35mm film)

OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION

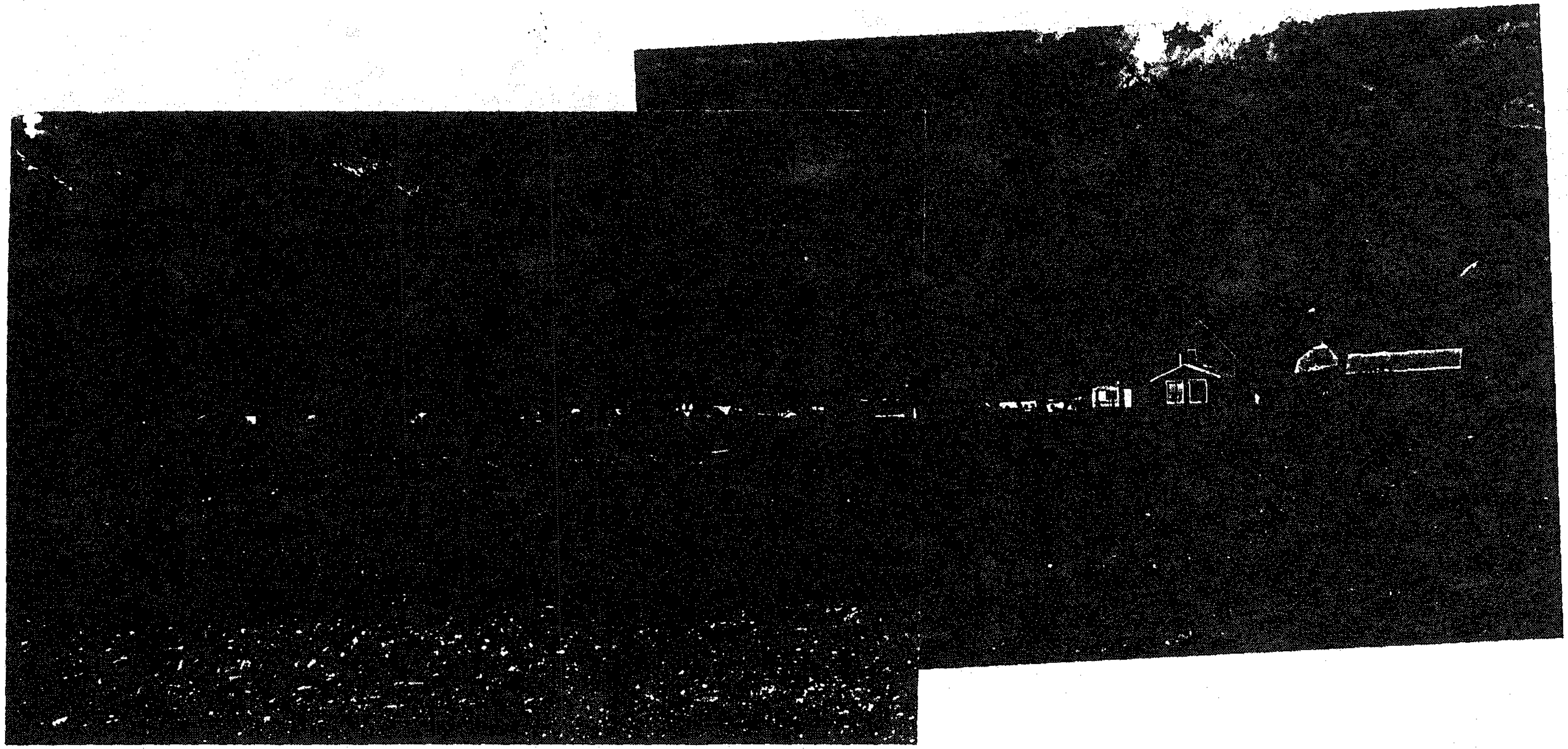


Description of Photo: CC-SE-M-34 Mineral Creek above confluence with the Animas River.

Date: October 2, 1996 Time: 1050

Direction facing: Northwest (35mm film)

OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION

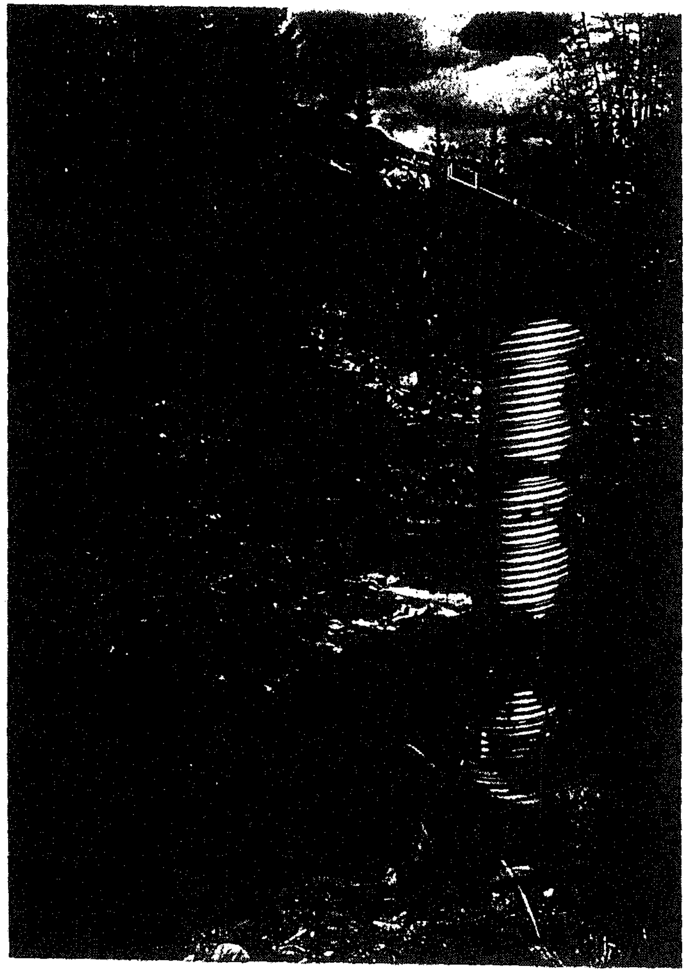


Description of Photo: CC-SE-A-68 Animas River above the confluence with Cement Creek (looking downstream toward Silverton.

Date: October 2, 1996 Time: 1107

Direction facing: Southwest (35mm film)

OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION



Description of Photo: CC-SE-CC-48 Cement Creek above the confluence with the Animas River.

Date: October 2, 1996 Time: 1107

Direction facing: Northwest (35mm film)

Description of Photo: CC-SE-A-68 Animas River above confluence with Cement Creek (looking upstream).

Date: October 2, 1996 Time: 1120

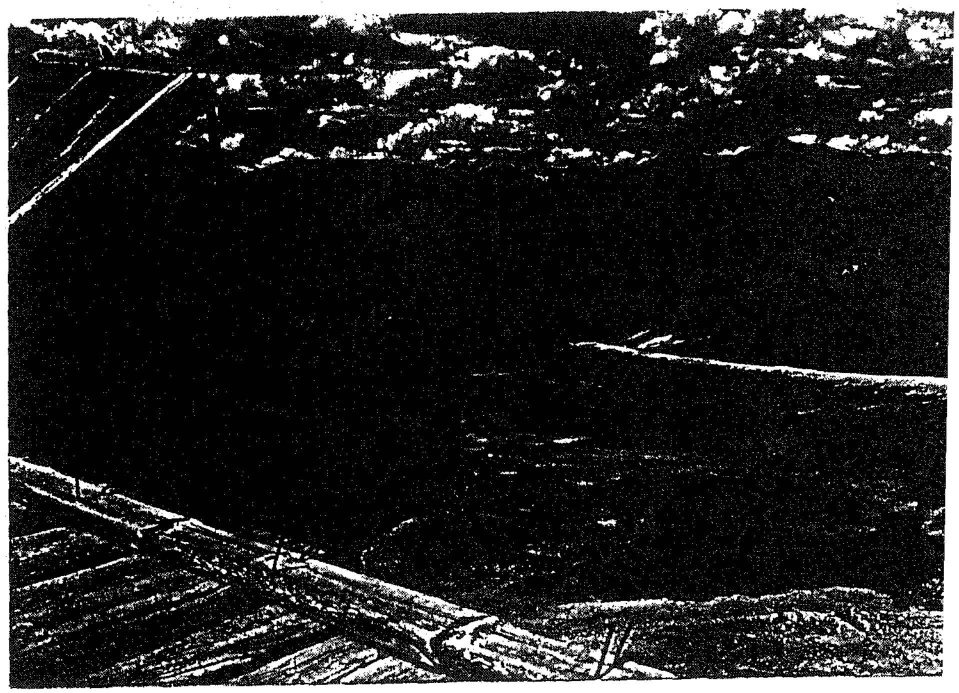
Direction facing: Northeast (35mm film)

OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION

Description of Photo: CC-SE-08 Cement Creek below Corkscrew G., above Red & Bonita Mine.

Date: August 12, 1996

Direction facing: North (35mm film)

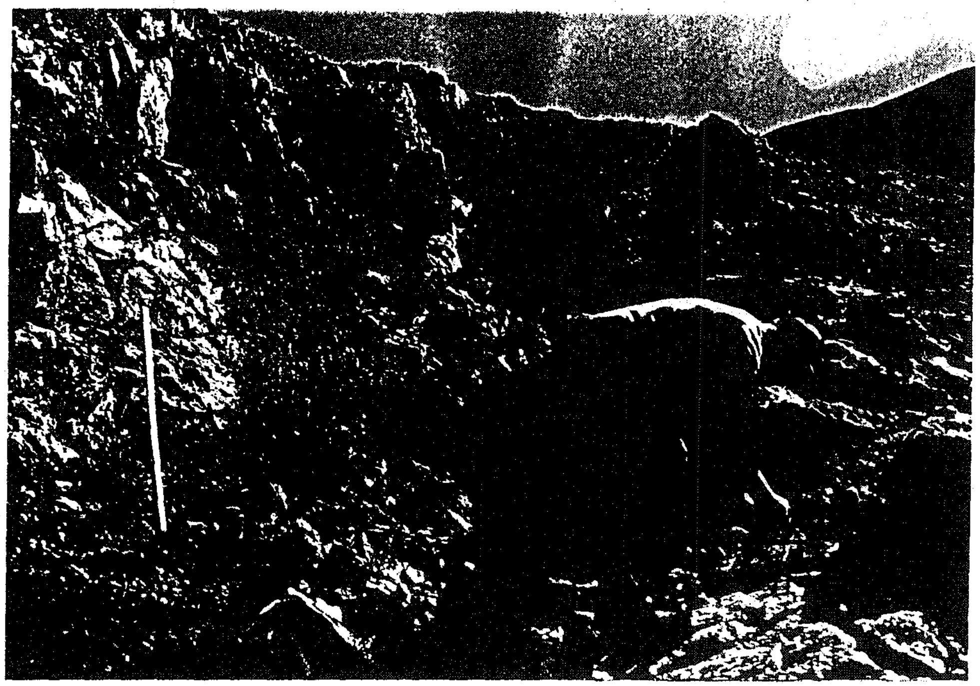


Description of photo: CC-SE-15 Minnehaha Creek below Lead Carbonate Mill Waste Pile.

Date: August 12, 1996

Direction facing: Southwest (35 mm film)

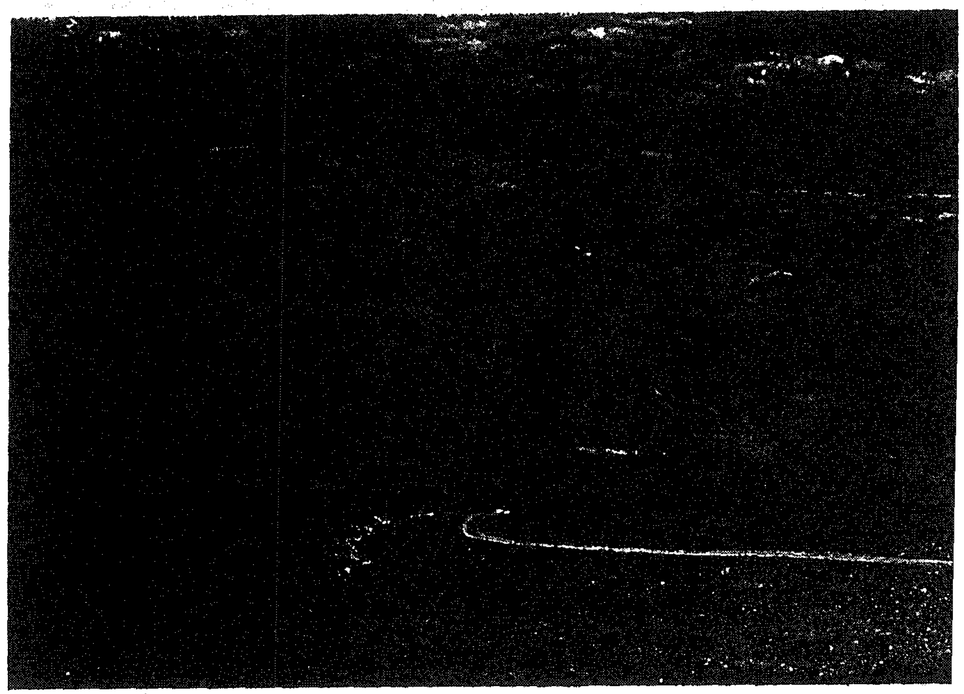
OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION



Description of Photo: CC-SE-01 Cement Creek upstream of the Queen Anne Mine.

Date: August 12, 1996 Time:

Direction facing: North (35mm film)

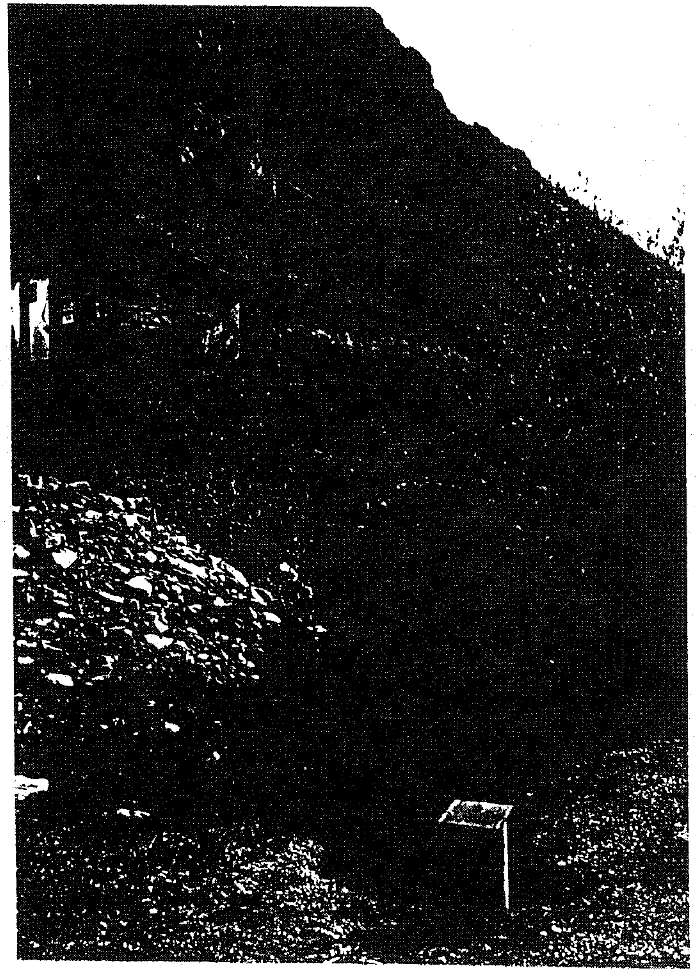


Description of Photo: CC-SE-02 Cement Creek below the Queen Anne Mine.

Date: August 12, 1996 Time:

Direction facing: Southwest (35mm film)

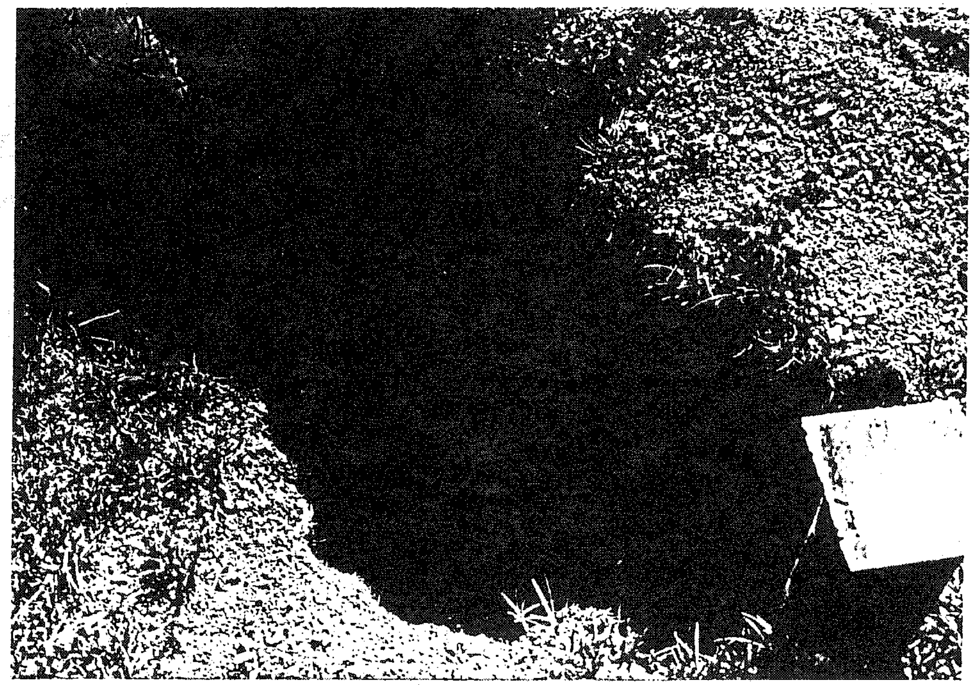
OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION



Description of Photo: GW-5 Mineral Creek well.

Date: September 17, 1996 Time: 1030

Direction facing: Northeast (35mm film)

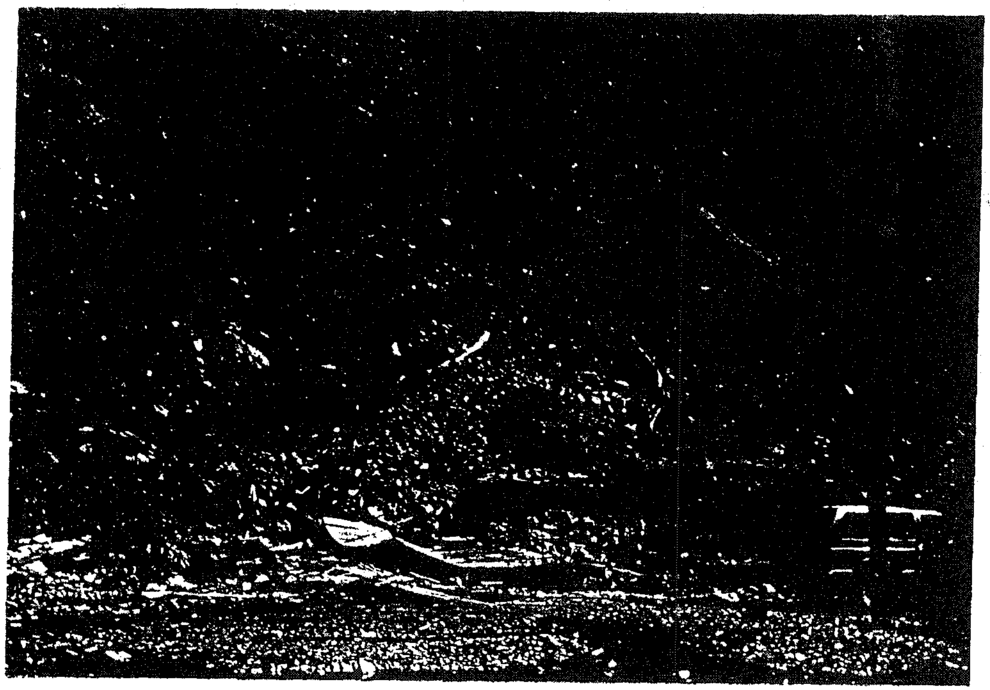


Description of Photo: GW-5 Mineral Creek well.

Date: September 17, 1996 Time: 1030

Direction facing: Northeast (35mm film)

OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION



Description of Photo: GW-4 Drinking water from the Leonard mine in Cunningham Creek.

Date: September 16, 1996 Time: 1450

Direction facing: Northeast (35mm film)

Description of Photo: GW-4 Drinking water from the Leonard mine in Cunningham Gulch.

Date: September 16, 1996 Time: 1450

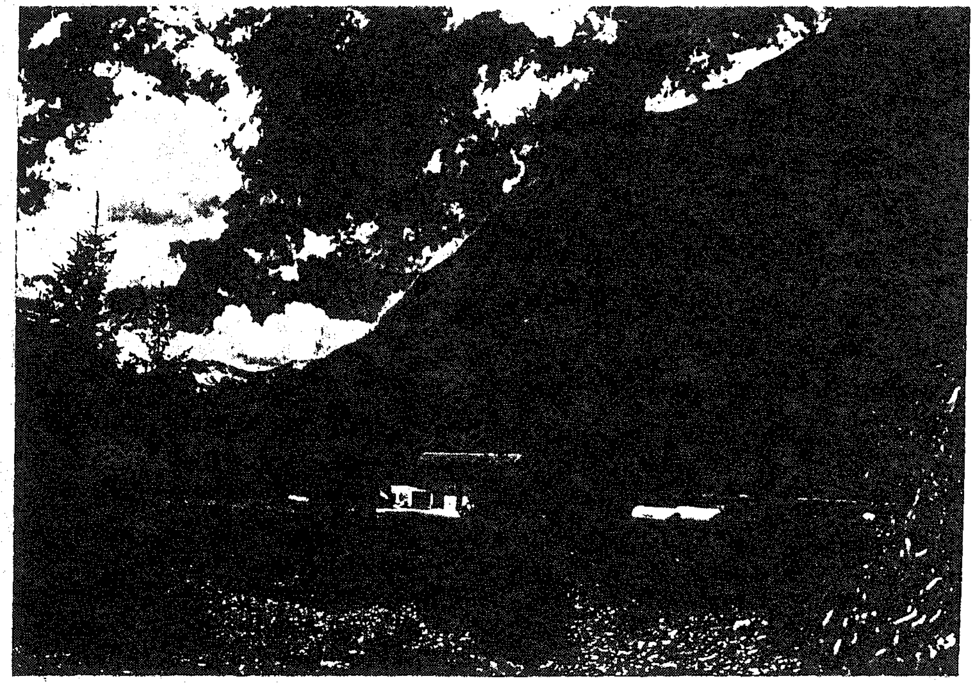
Direction facing: Northeast (35mm film)

OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION

Description of Photo: GW-3 Industrial Park upstream of Howardsville.

Date: September 16, 1996 Time: 1325

Direction facing: Northeast (35mm film)

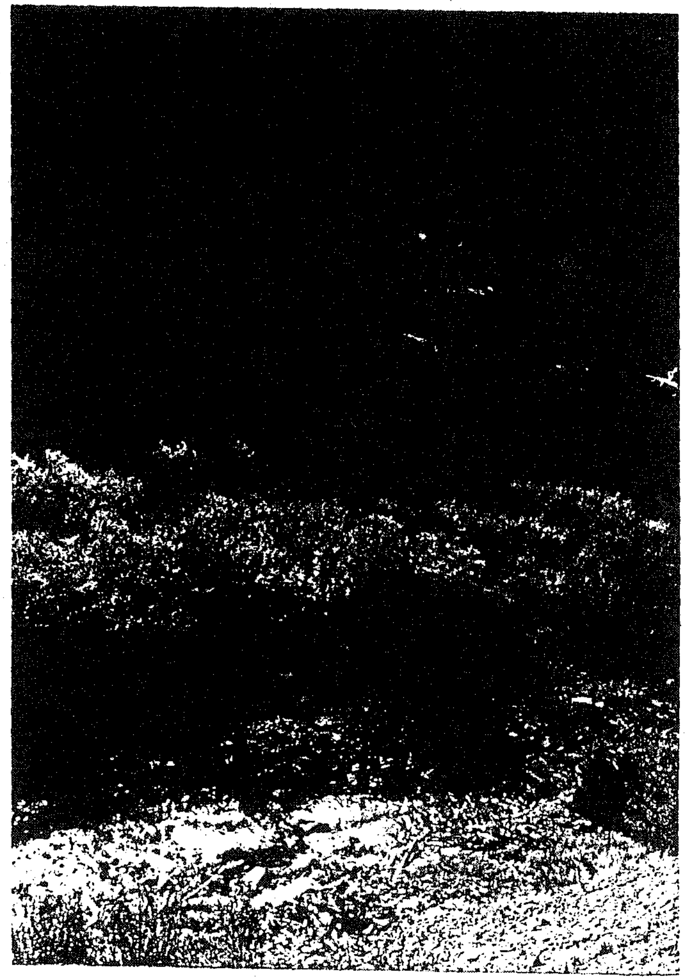


Description of Photo: GW-3 Industrial Park upstream of Howardsville.

Date: September 16, 1996 Time: 1325

Direction facing: Southwest (35mm film)

OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION

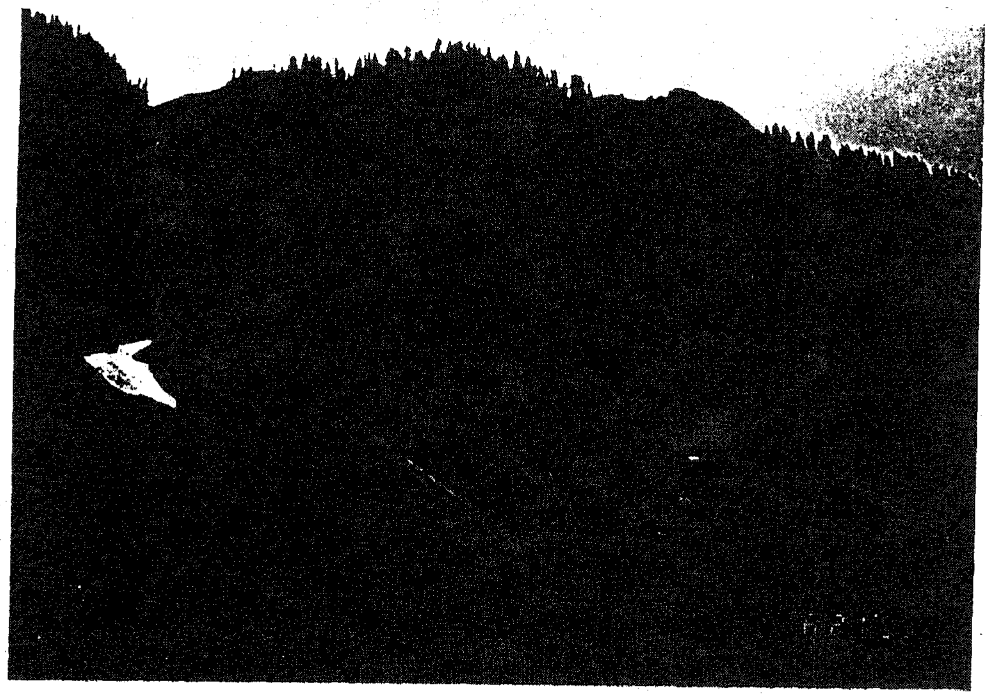


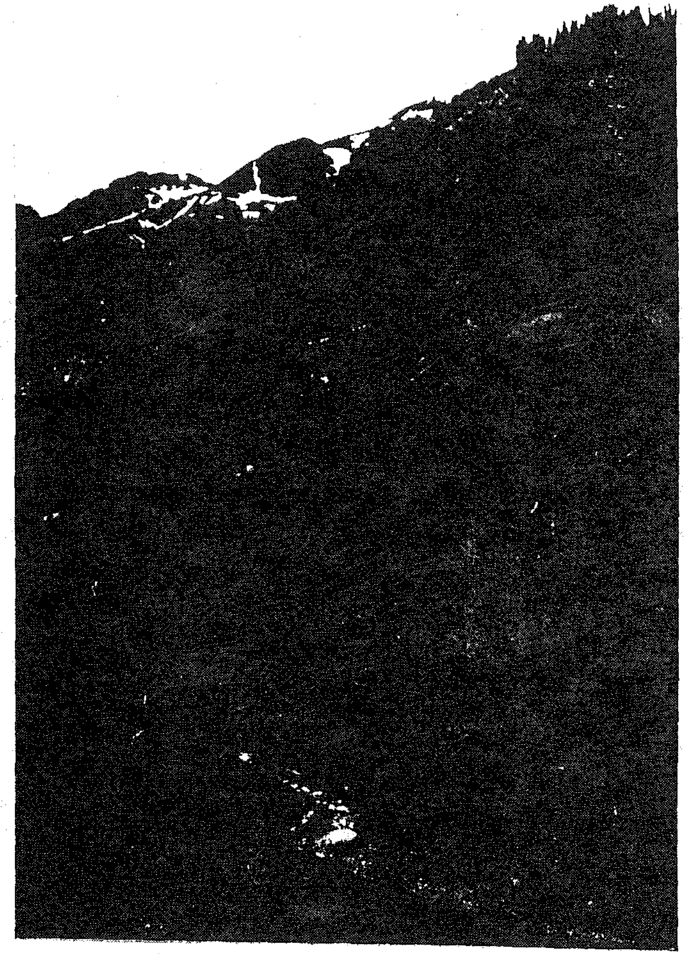
Description of Photo: GW-1 Cement Creek Drinking water well.

Date: September 16, 1996 Time: 0945

Direction facing: Southeast (35mm film)

OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION





Description of Photo: Big Colorado Mine across South Fork from the Silver Ledge Mine.

Date: August 7, 1996

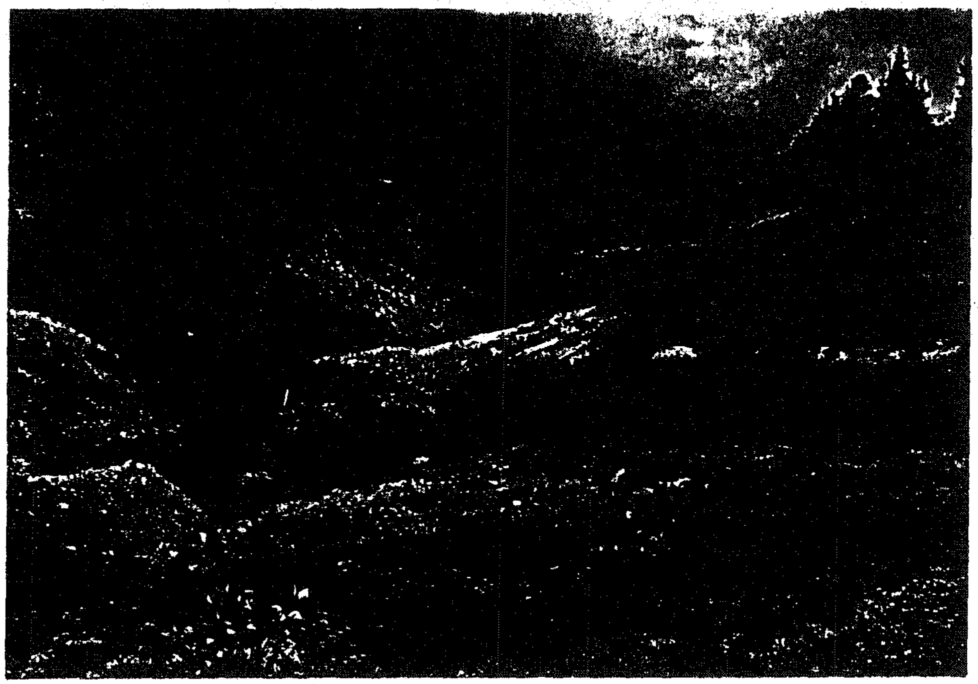
Direction facing: Southwest (35mm film)

Description of Photo: Big Colorado Mine across South Fork from the Silver Ledge Mine.

Date: August 7, 1996

Direction facing: Southeast (35mm film)

OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION



Description of Photo: PG-SE-01 Prospect Gulch upstream of the Galena Queen Mine.

Date: August 9, 1996

Direction facing: West (35mm film)

Description of Photo: PG-SE-01 Prospect Gulch upstream of the Galena Queen Mine.

Date: August 9, 1996

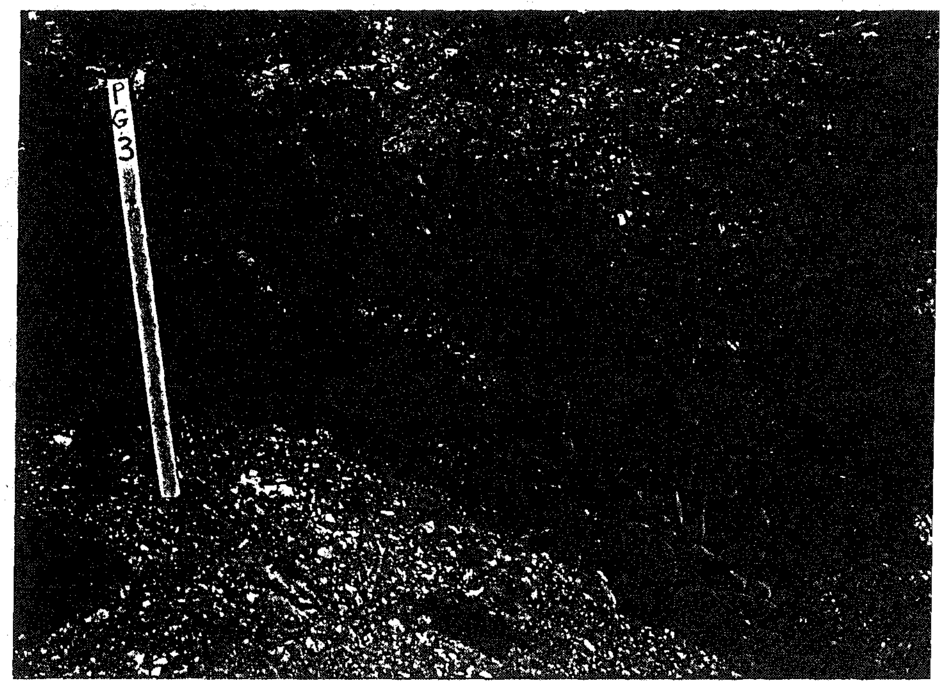
Direction facing: West (35mm film)

OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION

Description of Photo: PG-SE-03 Prospect Gulch below the Galena Queen Mine.

Date: August 9, 1996

Direction facing: West (35mm film)

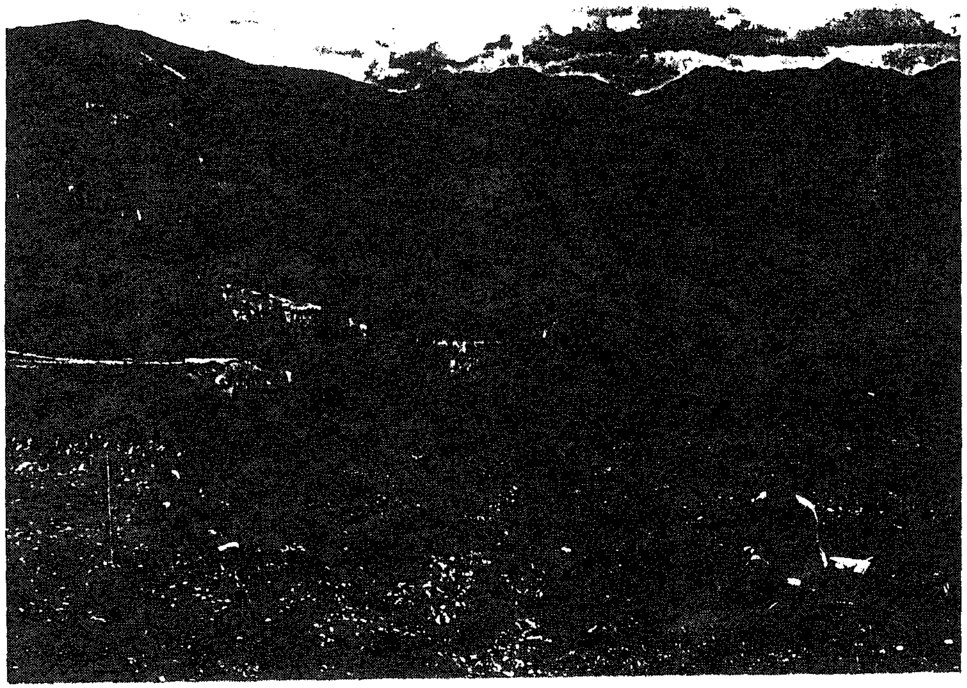


Description of Photo: PG-SE-03 Prospect Gulch below the Galena Queen Mine.

Date: August 9, 1996

Direction facing: West (35mm film)

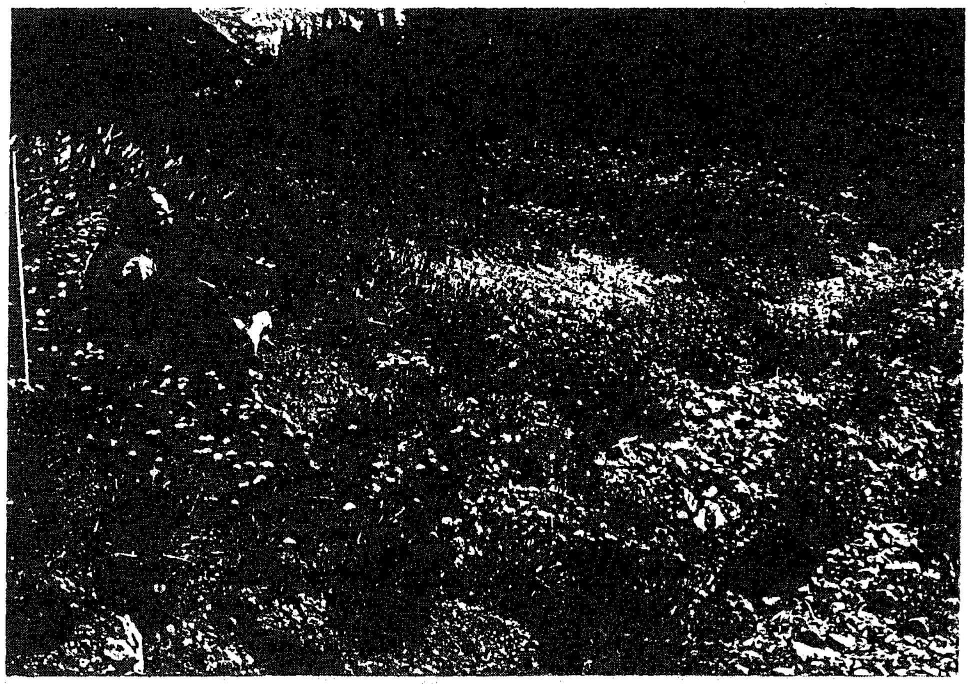
OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION



Description of Photo: PG-SE-04 Tributary to Prospect Gulch.

Date: August 9, 1996

Direction facing: Northeast (35mm film)

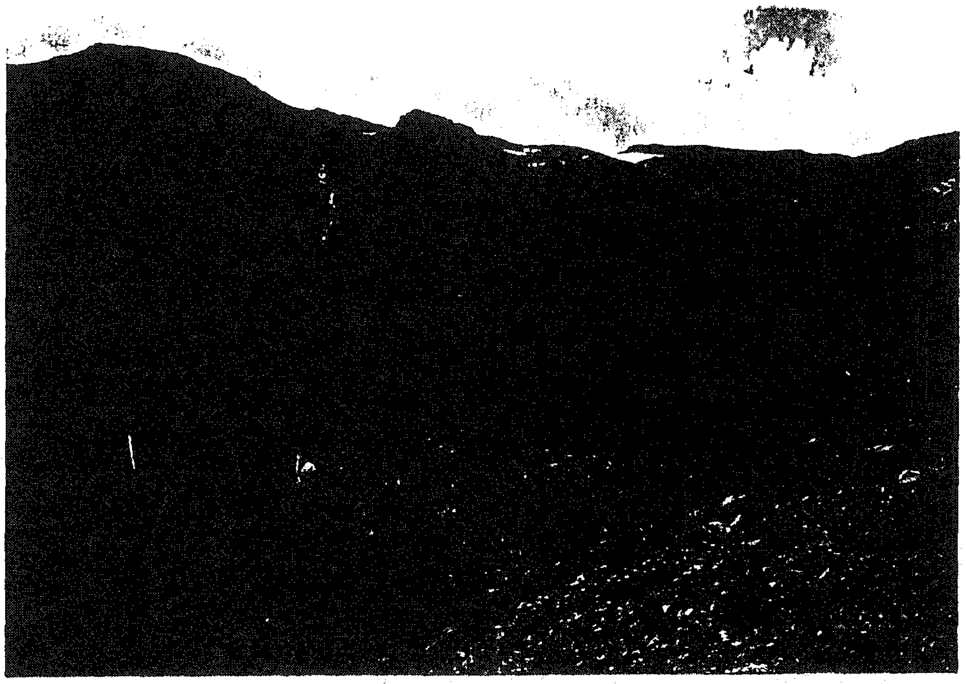


Description of Photo: PG-SE-04 Tributary to Prospect Gulch.

Date: August 9, 1996

Direction facing: Southwest (35mm film)

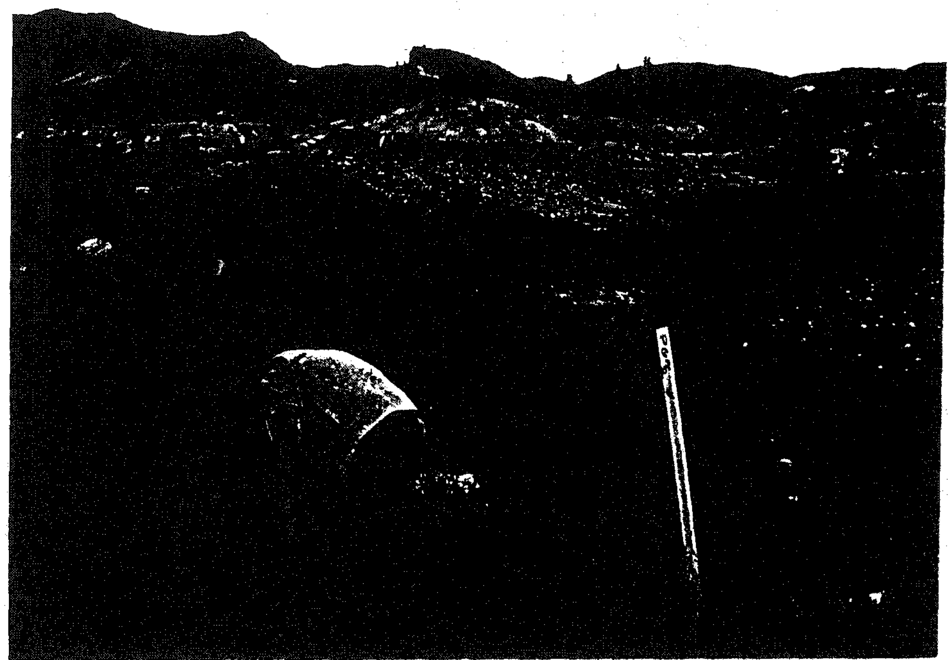
OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION



Description of Photo: PG-SE-05 Tributary with acid rock drainage.

Date: August 9, 1996

Direction facing: Southwest (35mm film)

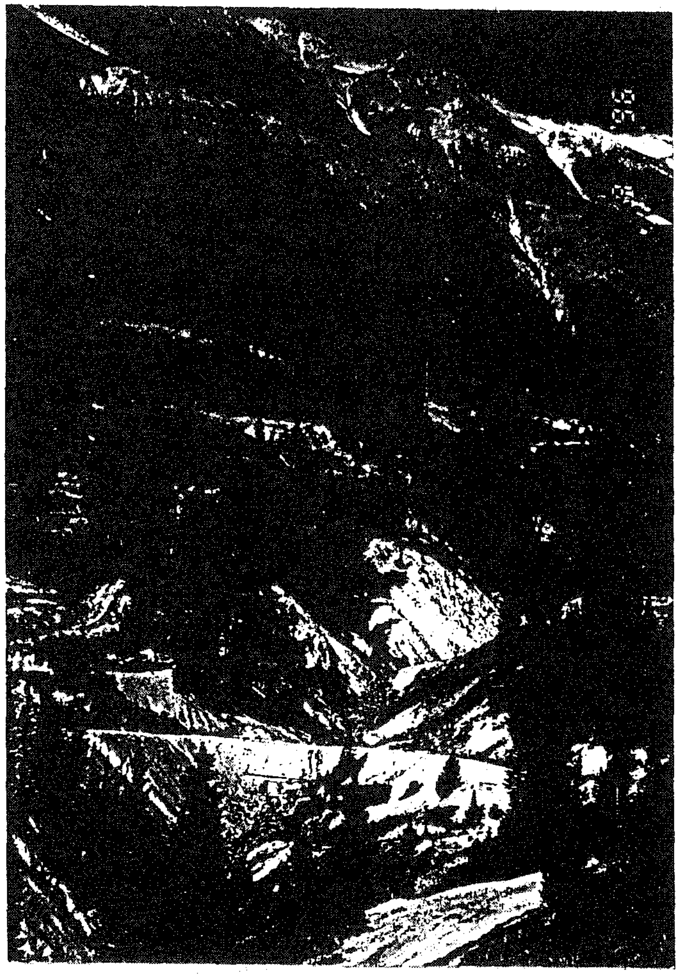


Description of Photo: PG-SE-06 Tributary with Hercules Mine located therein.

Date: August 9, 1996

Direction facing: Northwest (35mm film)

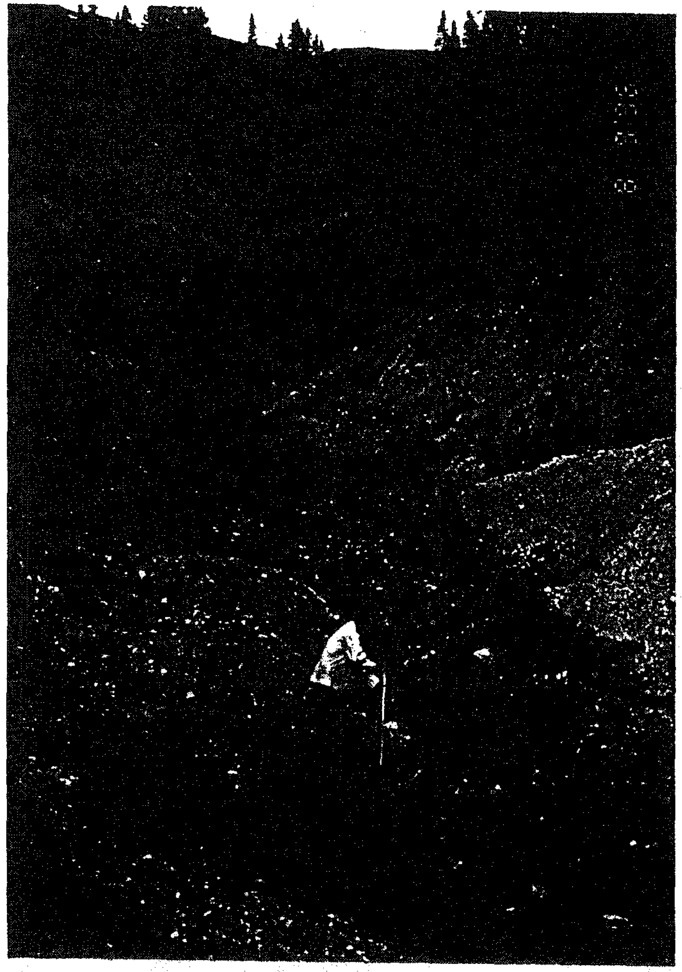
OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION



Description of Photo: PG-SE-09 Prospect Gulch below mineralized canyon, above Henrietta Mine.

Date: August 9, 1996

Direction facing: West (35mm film)

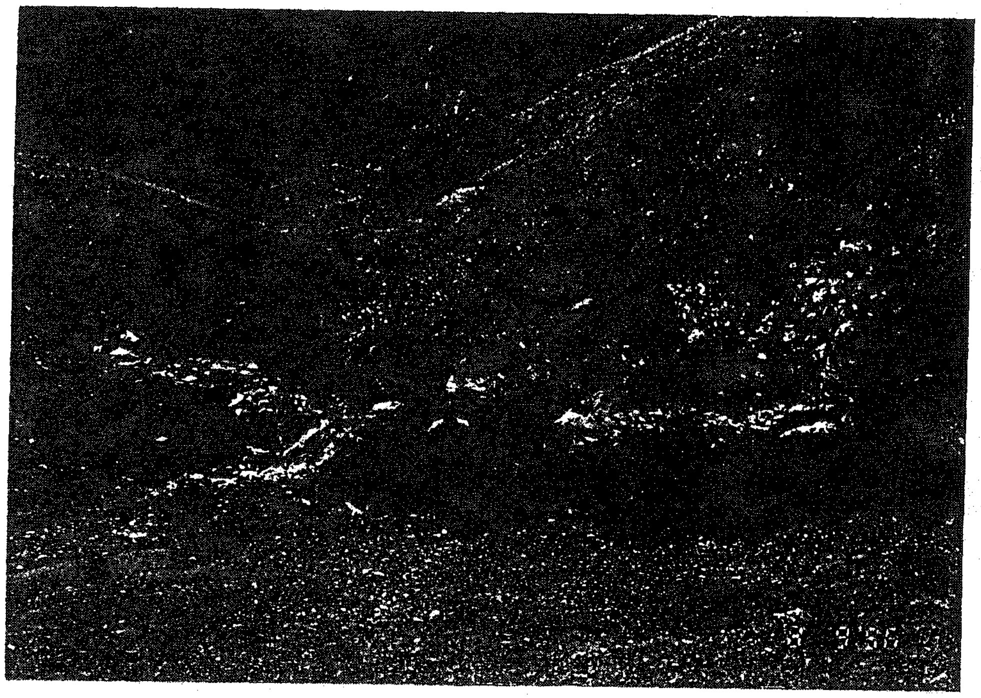


Description of Photo: PG-SE-09 Prospect G. below mineralized canyon, above Henrietta Mine.

Date: August 9, 1996

Direction facing: West (35mm film)

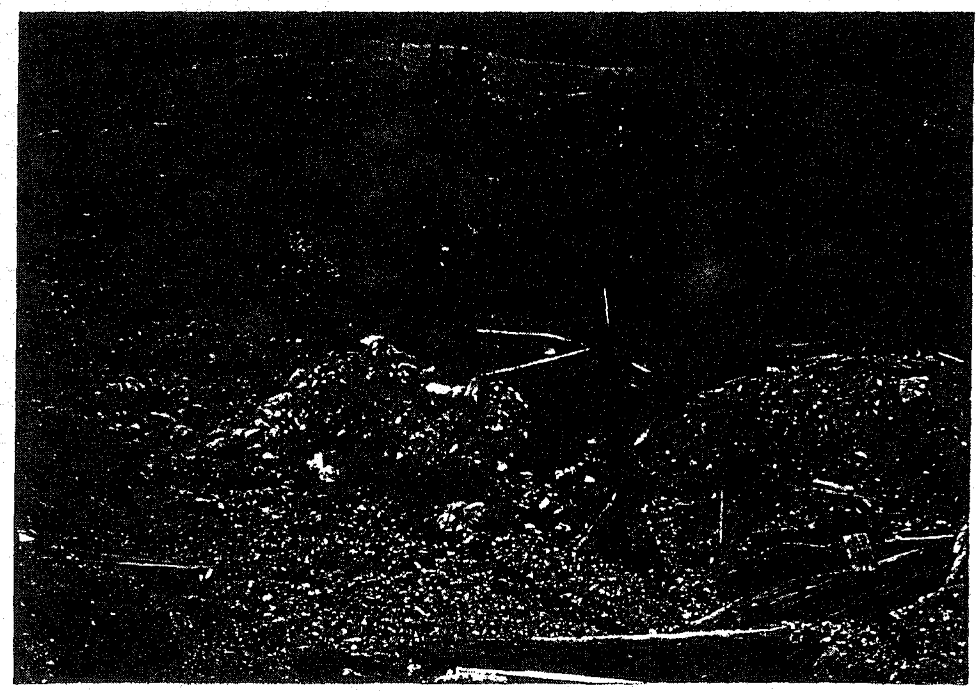
OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION



Description of Photo: PG-SE-09 Prospect Gulch below mineralized canyon, above Henrietta Mine.

Date: August 9, 1996

Direction facing: Southeast (35mm film)

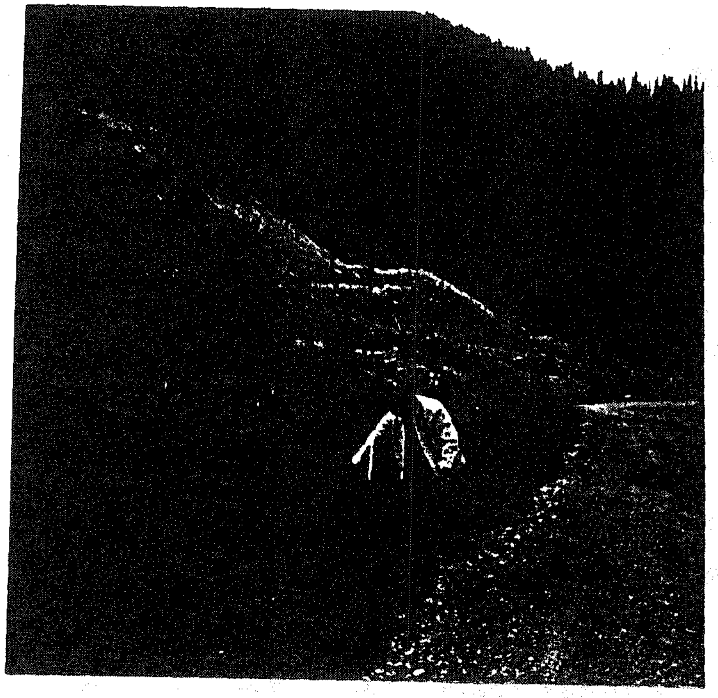


Description of Photo: PG-SE-10 (left) & 11 (right) Prospect G. below mineralized tributary (PG-10).

Date: August 9, 1996

Direction facing: Northwest (35mm film)

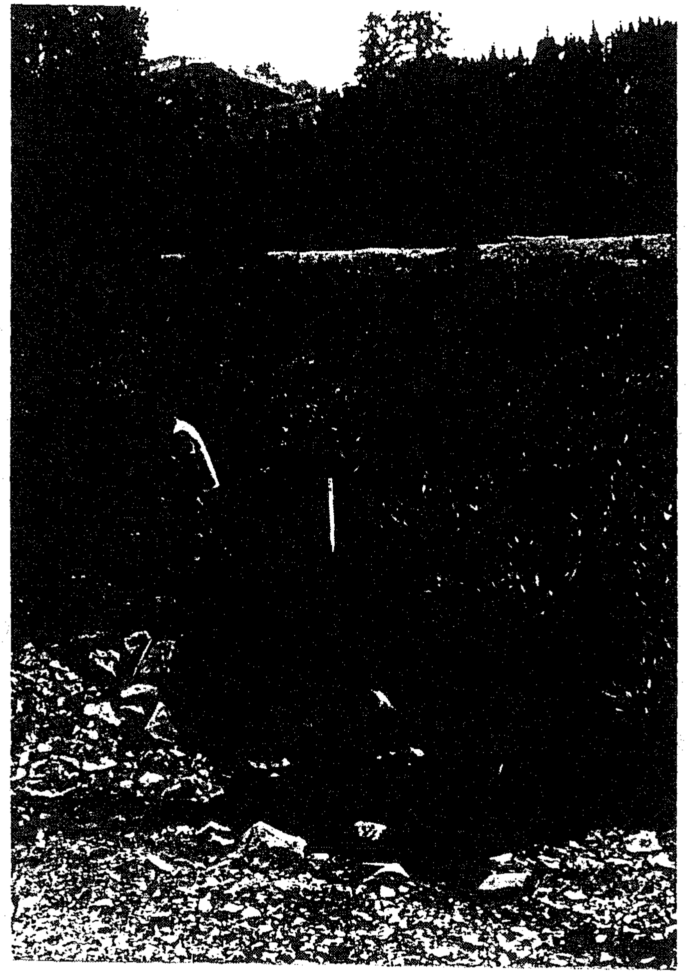
OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION



Description of Photo: PG-SE-12 Perennial springs upgradient of the Lark Mine.

Date: August 9, 1996

Direction facing: East (35mm film)

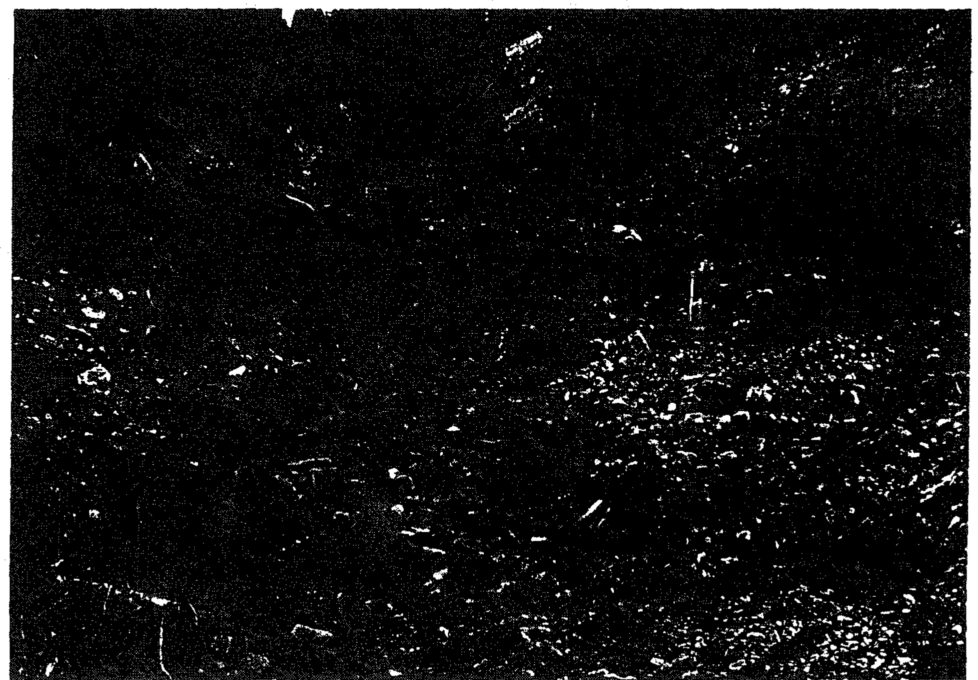


Description of Photo: PG-SE-13 Springs on top of the Lark Mine waste pile.

Date: August 9, 1996

Direction facing: North (35mm film)

OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION



Description of Photo: PG-SE-14 (right) (PG-15 left) Springs after percolating through the Lark Mine waste pile.

Date: August 9, 1996

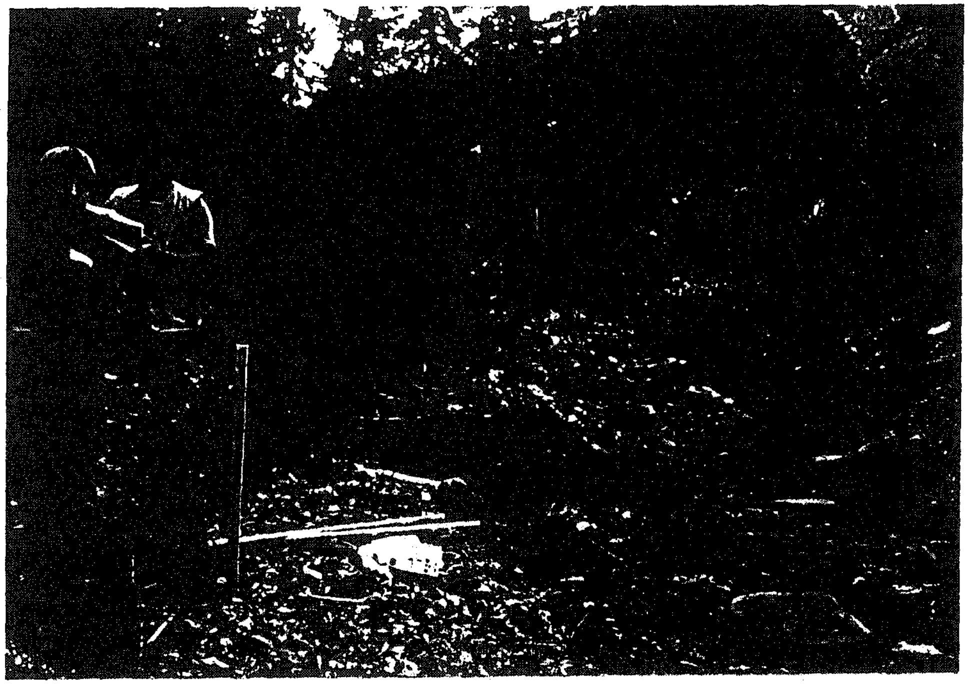
Direction facing: North (35mm film)

Description of Photo: PG-SE-15 Prospect G. below the Henrietta Mine waste complex, above the PPE of the Lark Mine springs.

Date: August 9, 1996

Direction facing: West (35mm film)

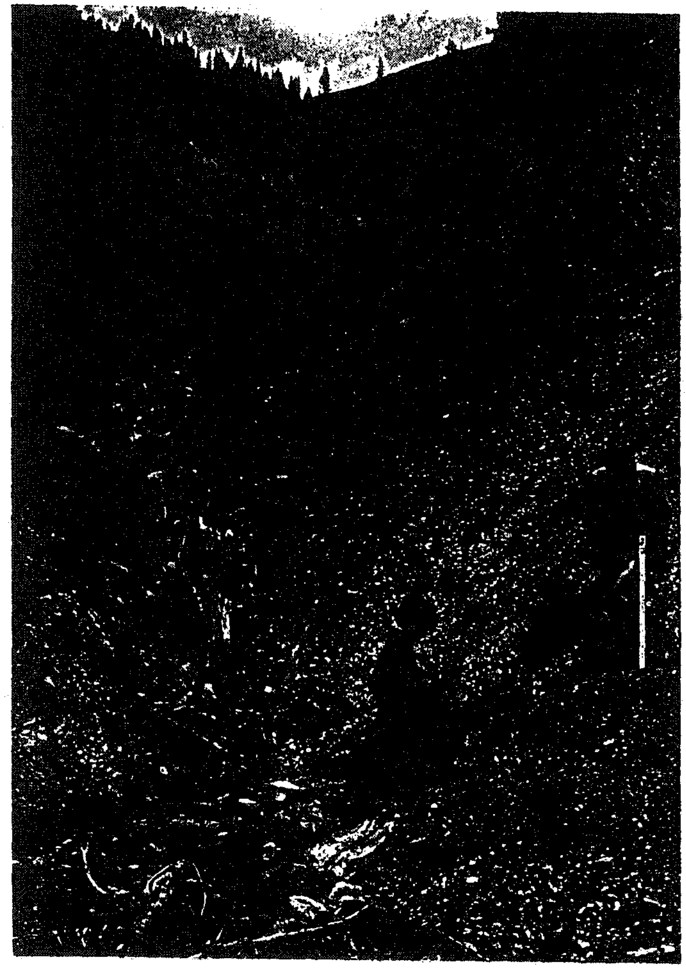
OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION



Description of Photo: PG-SE-16 Prospect Gulch below the Lark Mine waste pile springs.

Date: August 9, 1996

Direction facing: West (35mm film)



Description of Photo: PG-SE-17 Tributaries from the Upper Joe and John's Mine.

Date: August 9, 1996

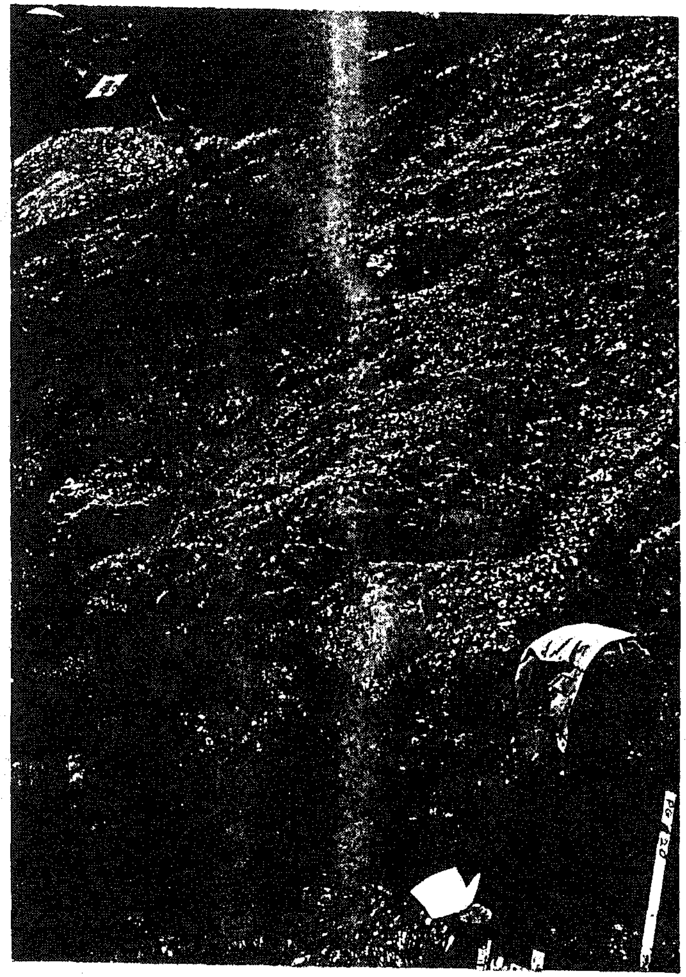
Direction facing: North (35mm film)

OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION

Description of Photo: PG-SE-18 Prospect Gulch below Joe and John's Mine.

Date: August 9, 1996

Direction facing: East (35mm film)

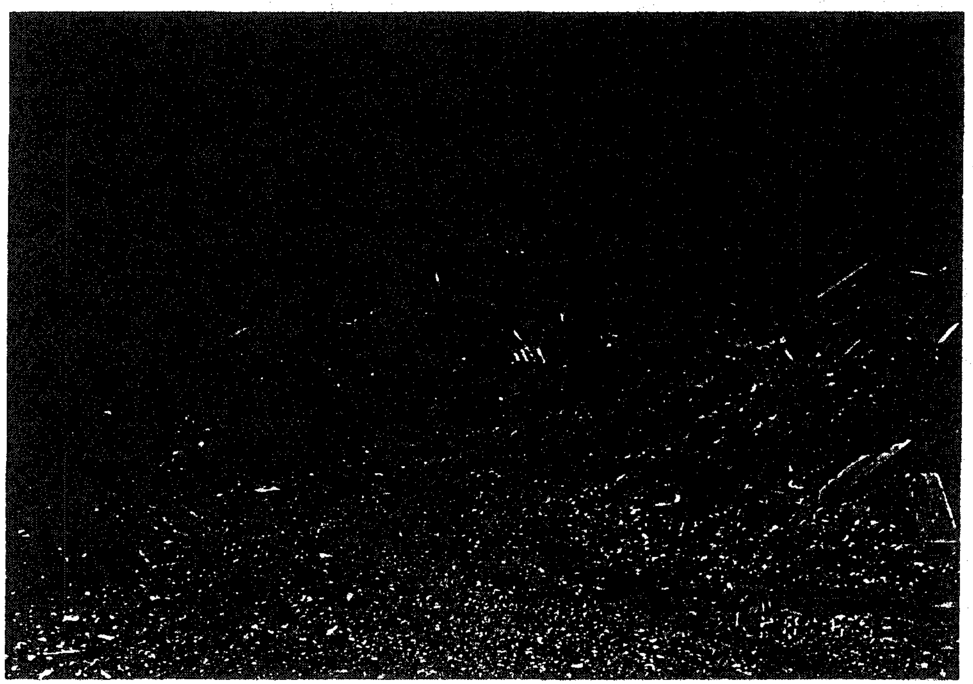


Description of Photo: PG-SE-20 Tributary east of the Hercules Mine.

Date: August 9, 1996

Direction facing: Southeast (35mm film)

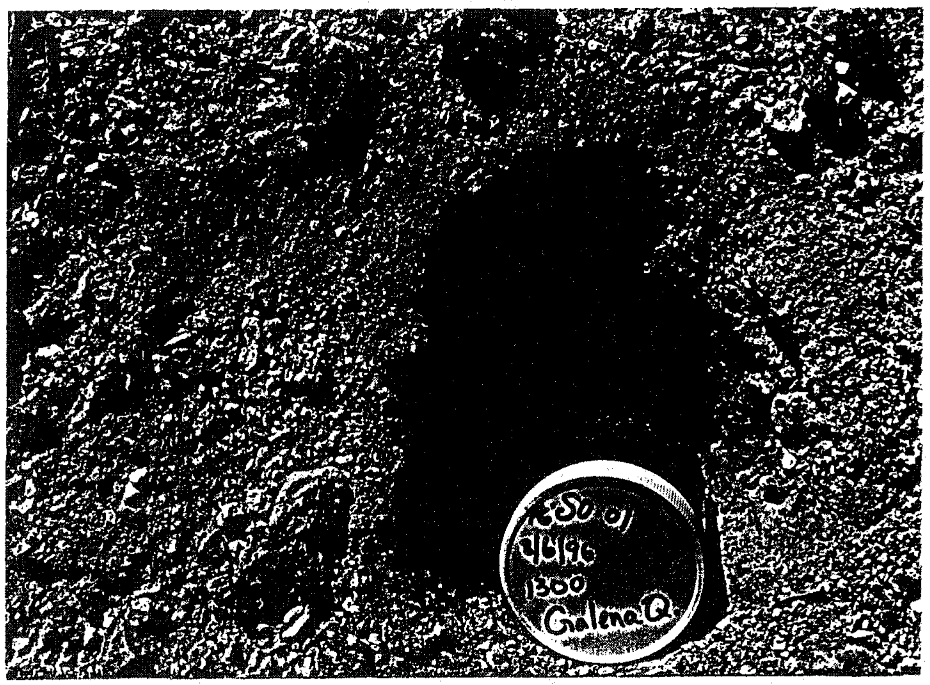
OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION



Description of Photo: PG-SO-01 Galena Queen Mine waste pile.

Date: August 6, 1996

Direction facing: West (35mm film)

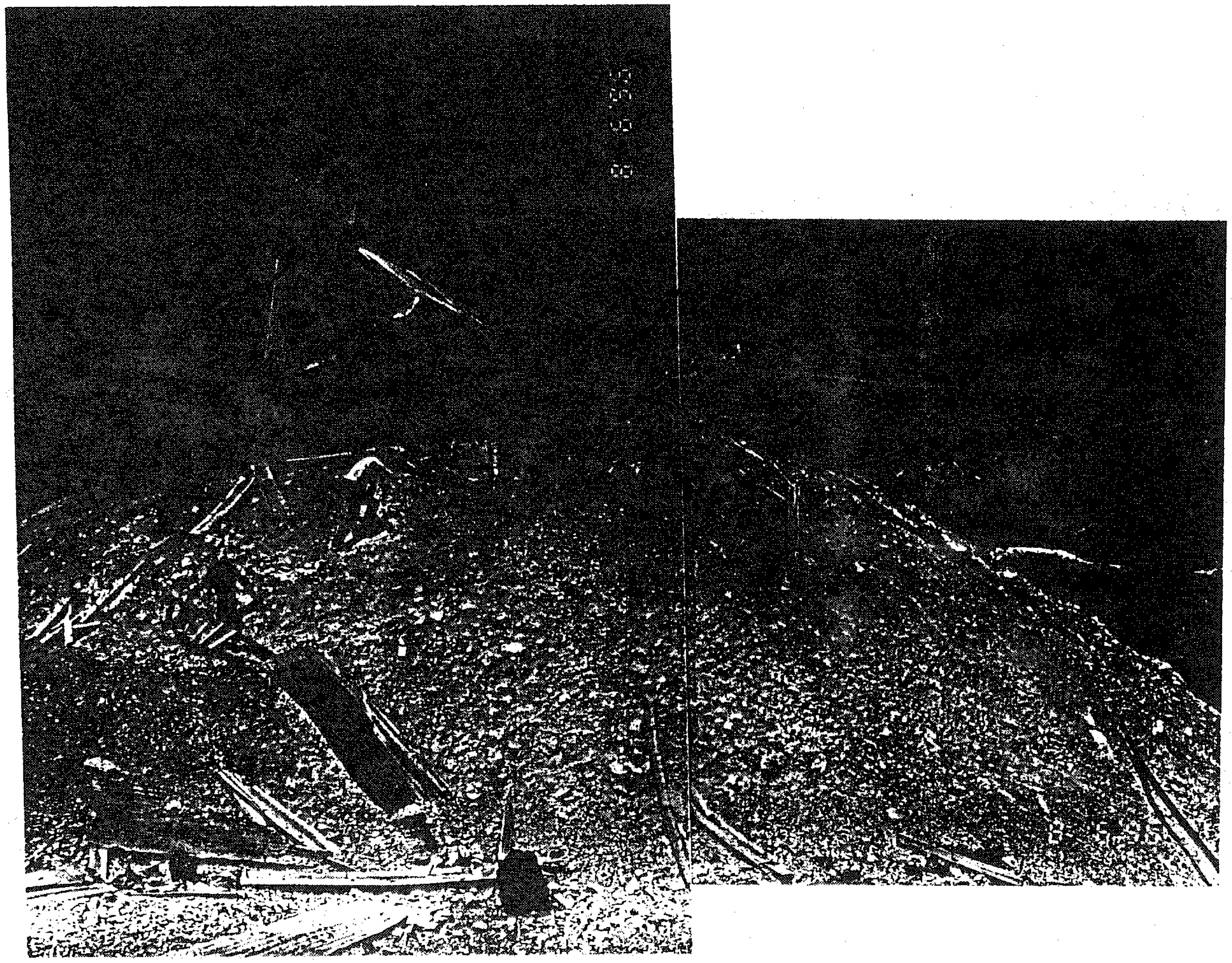


Description of Photo: PG-SO-01 Galena Queen Mine waste pile (closeup).

Date: August 6, 1996

Direction facing: West (35mm film)

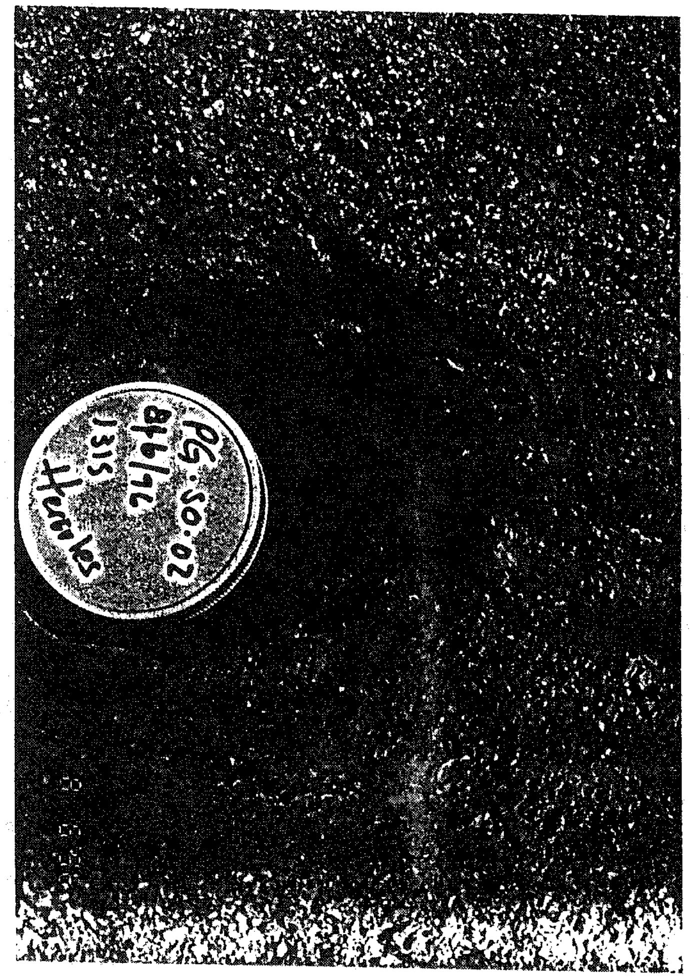
OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION



Description of Photo: PG-SO-02 Hercules Mine waste pile.

Date: August 6, 1996

Direction facing: Northwest (35mm film)



Description of Photo: PG-SO-02 Hercules Mine waste pile (closeup).

Date: August 6, 1996

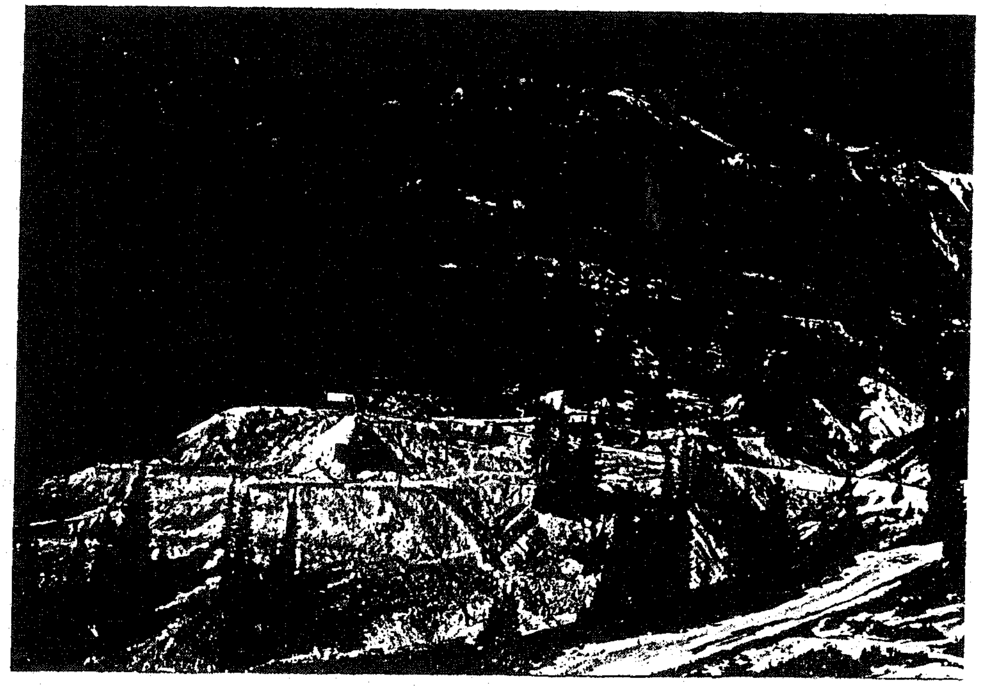
Direction facing: Northwest (35mm film)

OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION

Description of Photo: PG-SO-04 Henrietta 7 Mine waste pile.

Date: August 6, 1996

Direction facing: Southeast (35mm film)

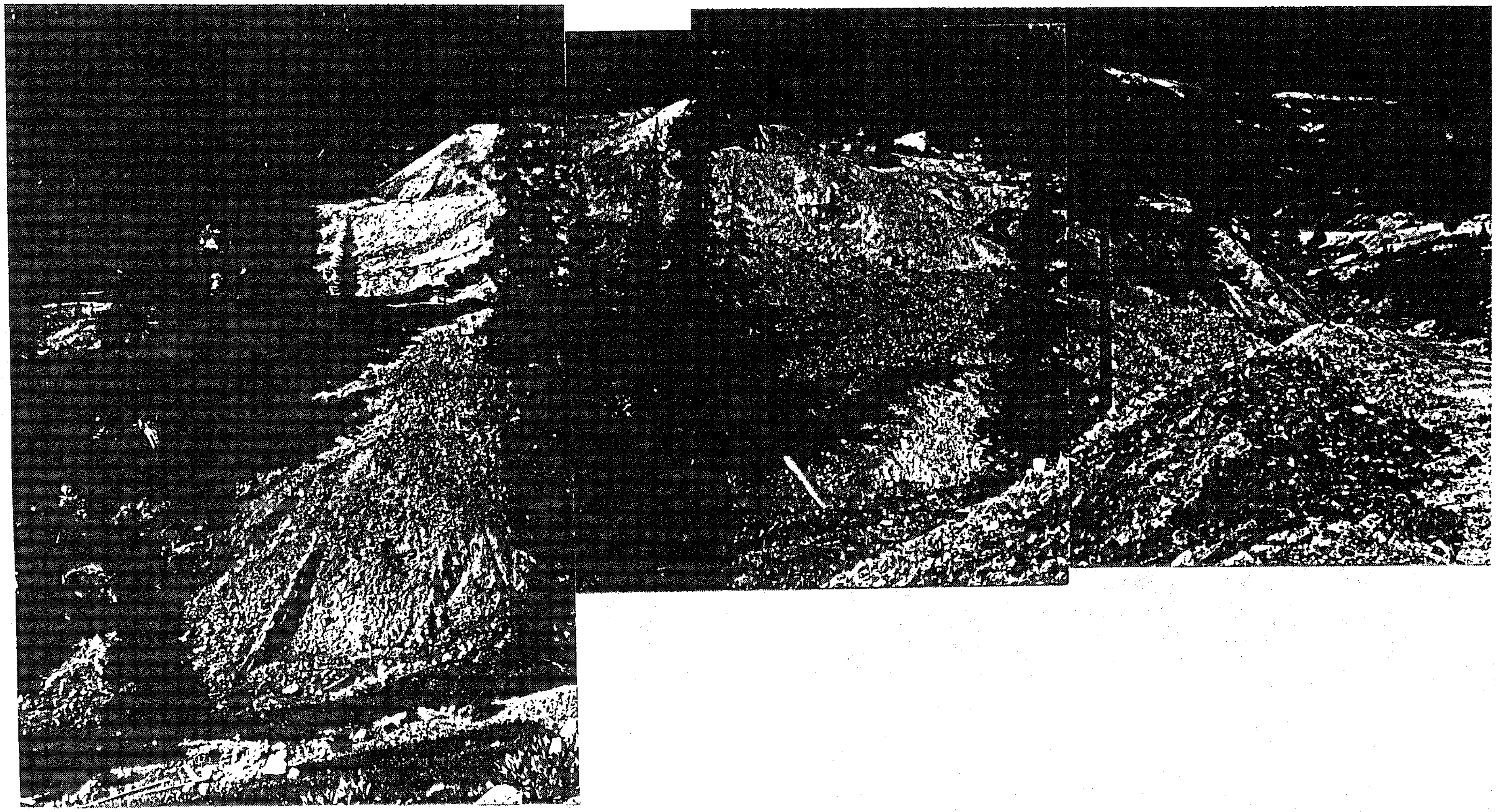


Description of Photo: PG-SO-04 Henrietta 7 Mine waste pile.

Date: August 6, 1996

Direction facing: Southwest (35mm film)

OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION

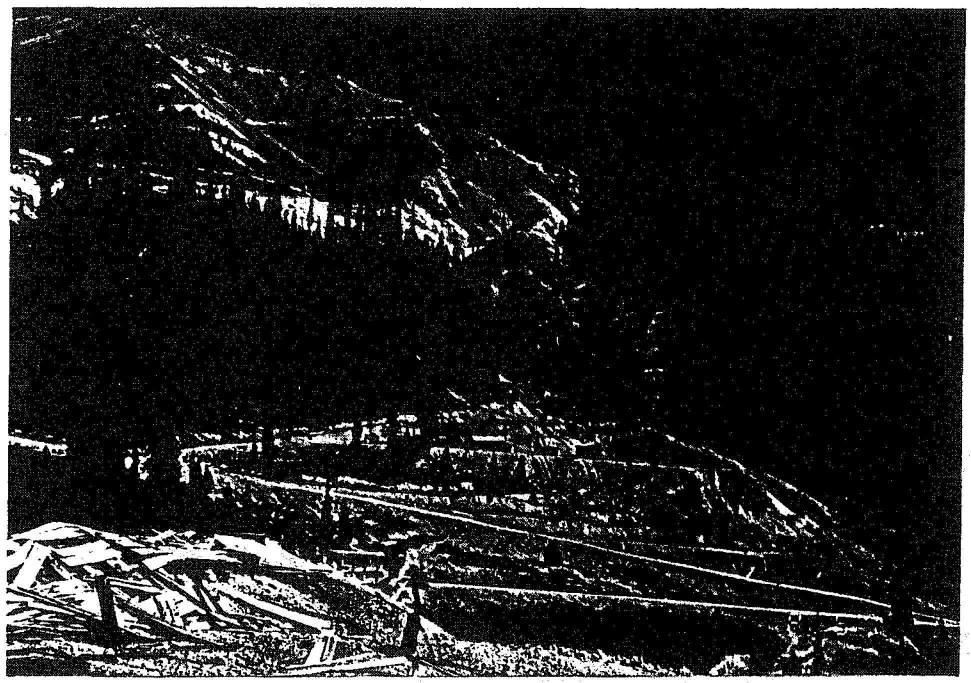


Description of Photo: PG-SO-04 Henrietta 7 Mine waste pile.

Date: August 6, 1996

Direction facing: North (35mm film)

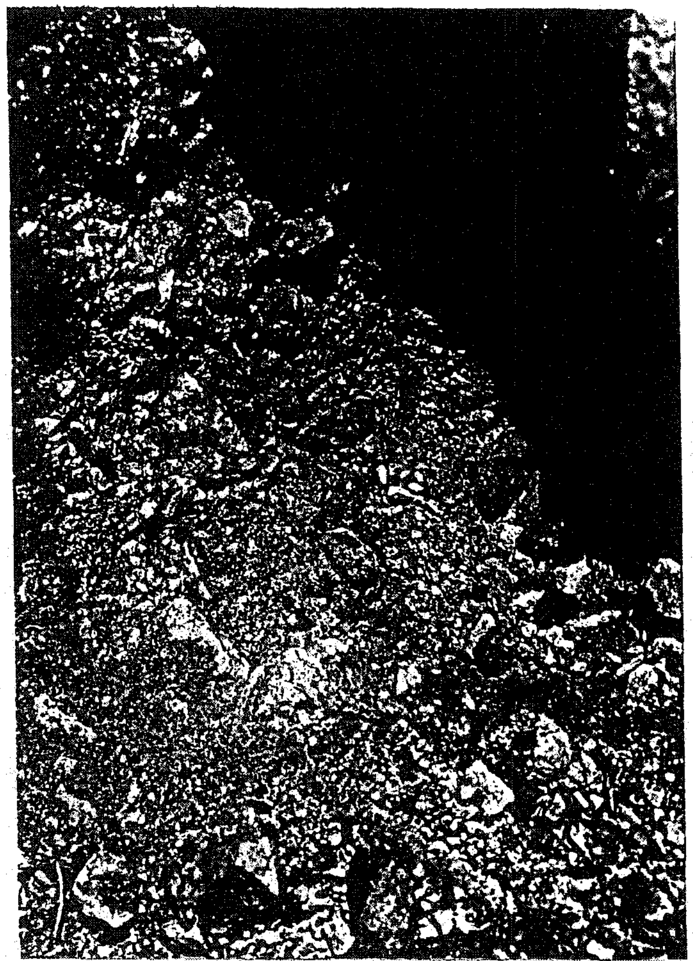
OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION



Description of Photo: PG-SO-05 Lark Mine waste pile.

Date: August 6, 1996

Direction facing: Northeast (35mm film)

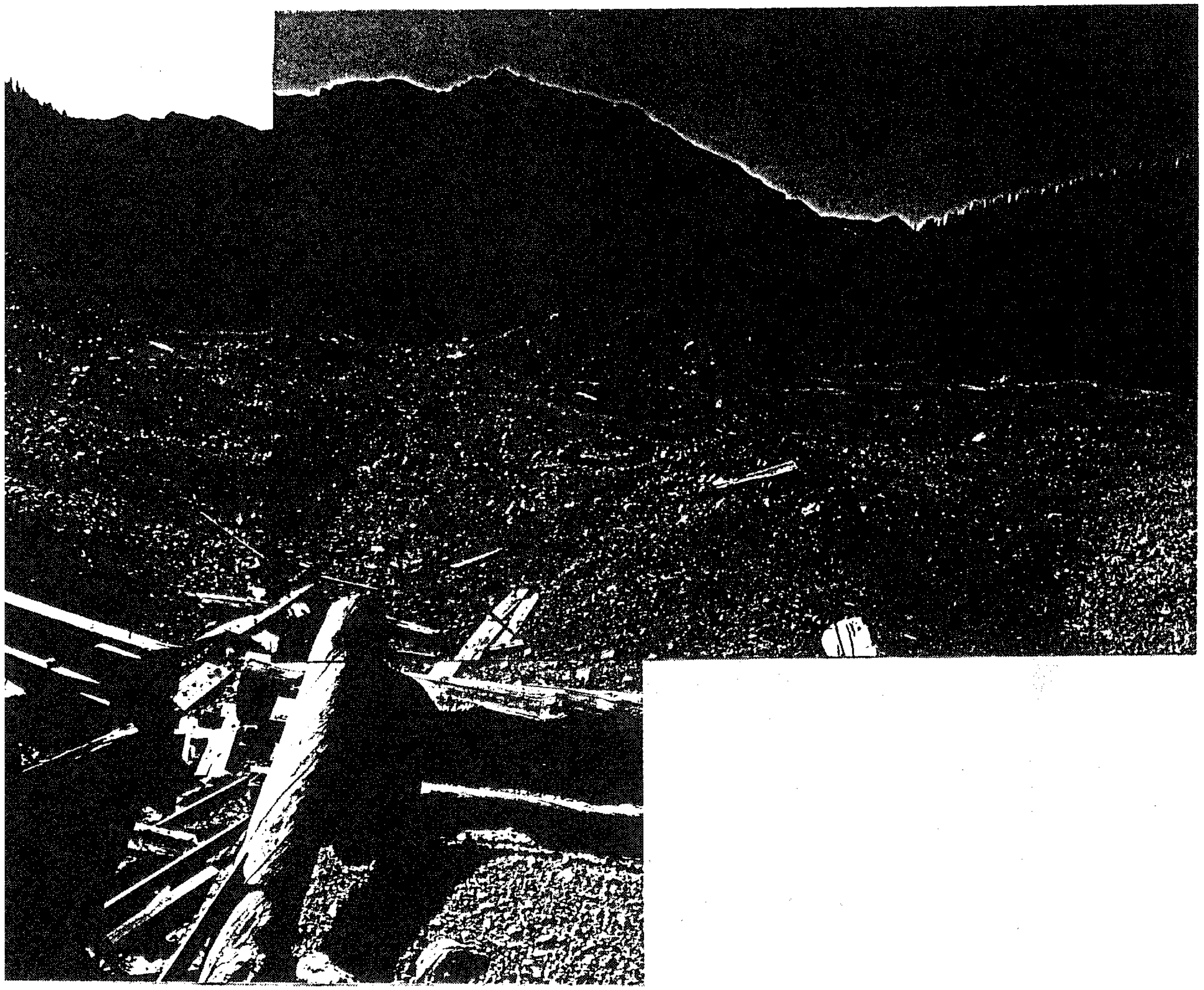


Description of Photo: PG-SO-05 Lark Mine waste pile (closeup).

Date: August 6, 1996

Direction facing: Northeast (35mm film)

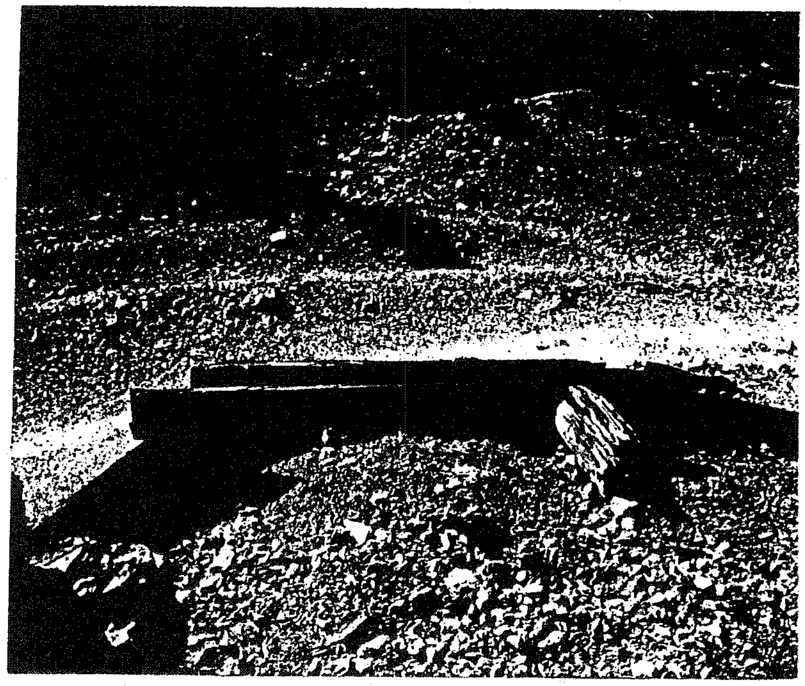
OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION



Description of Photo: PG-SO-05 Lark Mine drainage flow path.

Date: August 6, 1996

Direction facing: East (35mm film)

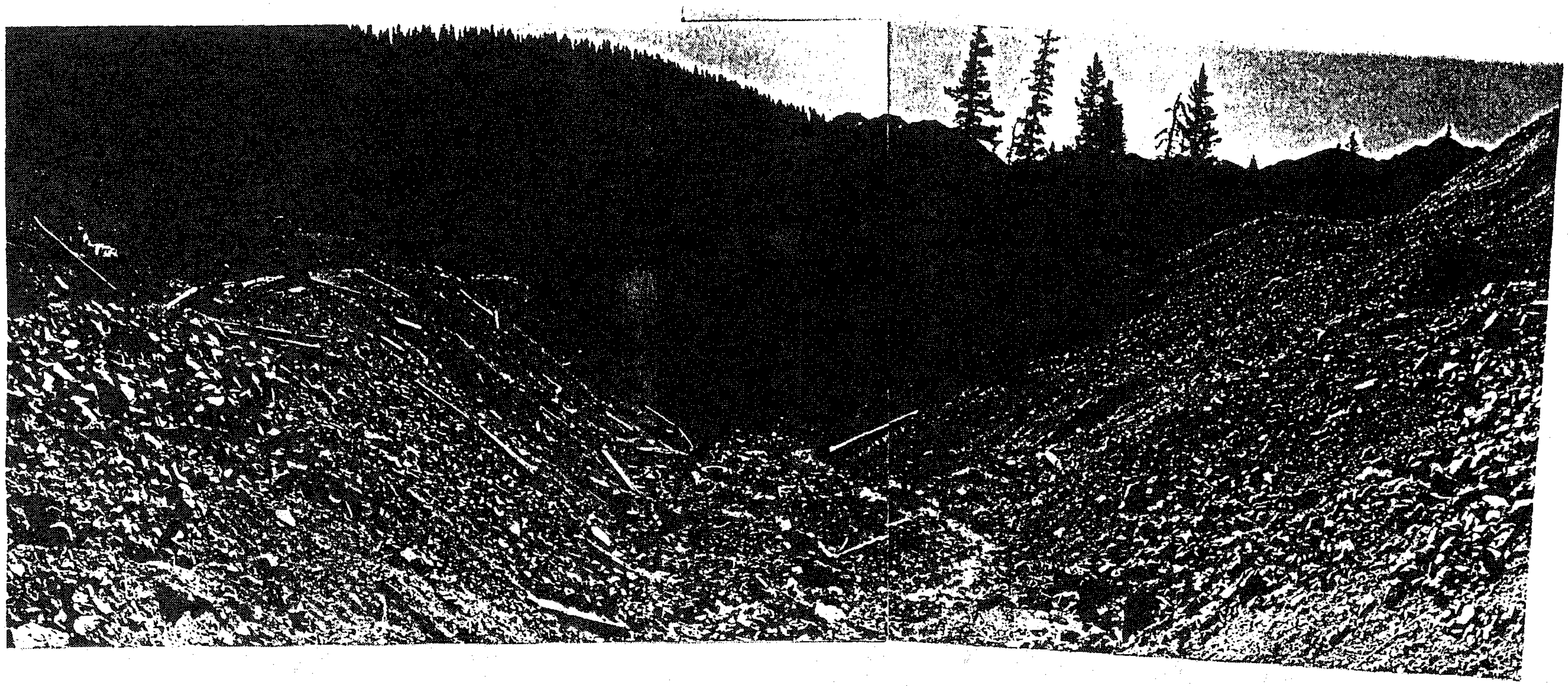


Description of Photo: PG-SO-05 Lark Mine drainage flow path, into drainage east of pile.

Date: August 6, 1996

Direction facing: East (35mm film)

OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION

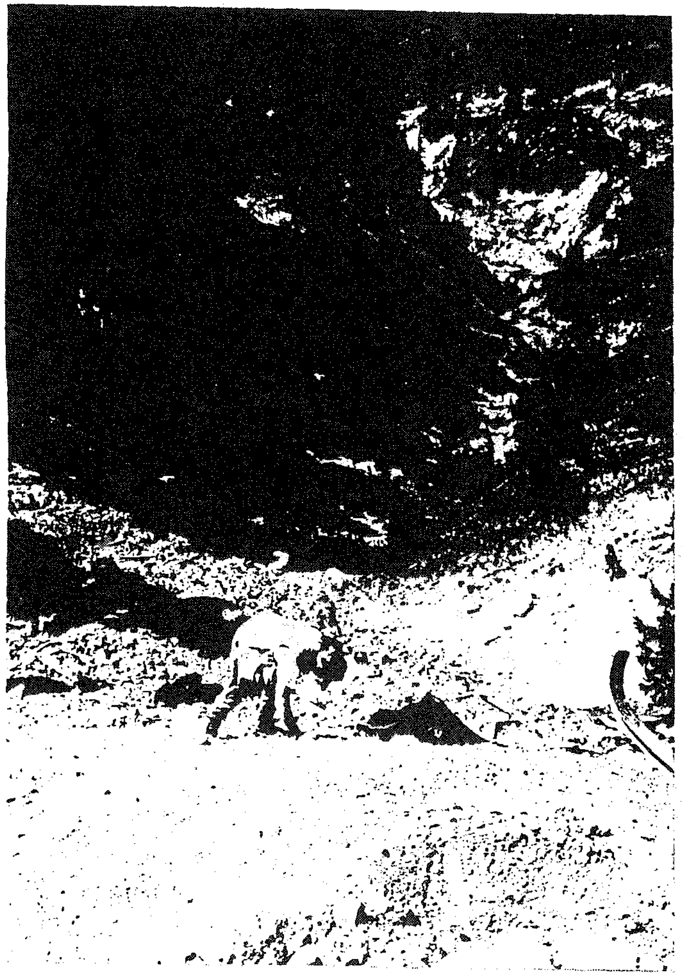


Description of Photo: Prospect Gulch flowing at toe of at Lark Mine waste pile (PG-SO-05; left) and Henrietta Waste rock pile (PG-SO-04; right).

Date: August 6, 1996

Direction facing: Southeast (35mm film)

OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION



Description of Photo: PG-SO-07 Joe and John's Mine waste rock pile.

Date: August 6, 1996

Direction facing: South (35mm film)

Description of Photo: PG-SO-07 Joe and John's Mine waste rock pile (closeup).

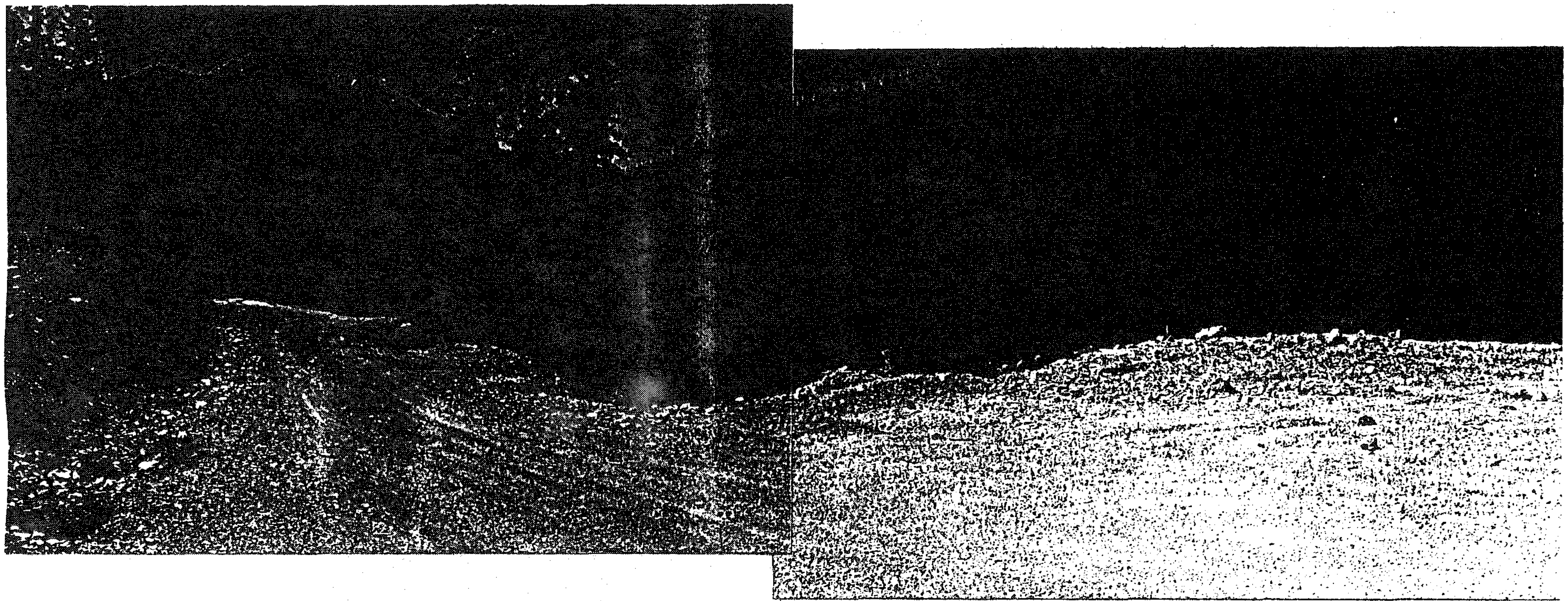
Date: August 6, 1996

Direction facing: North (35mm film)

ED 000552 00029910-00160

1800733

OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION

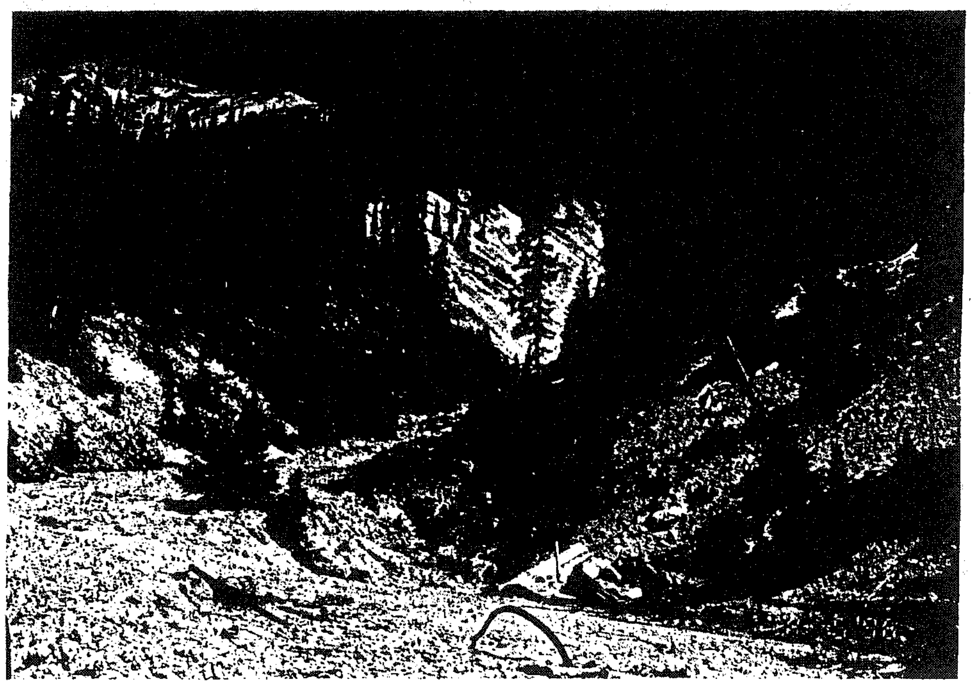


Description of Photo: PG-SO-07 Joe and John's Mine waste pile.

Date: August 6, 1996

Direction facing: East (35mm film)

OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION

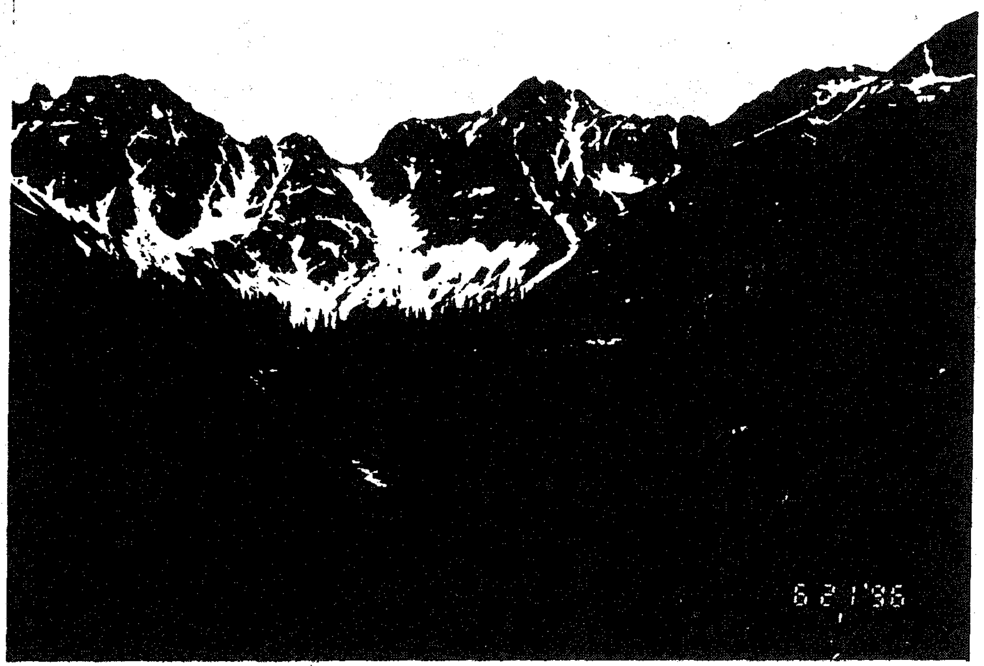


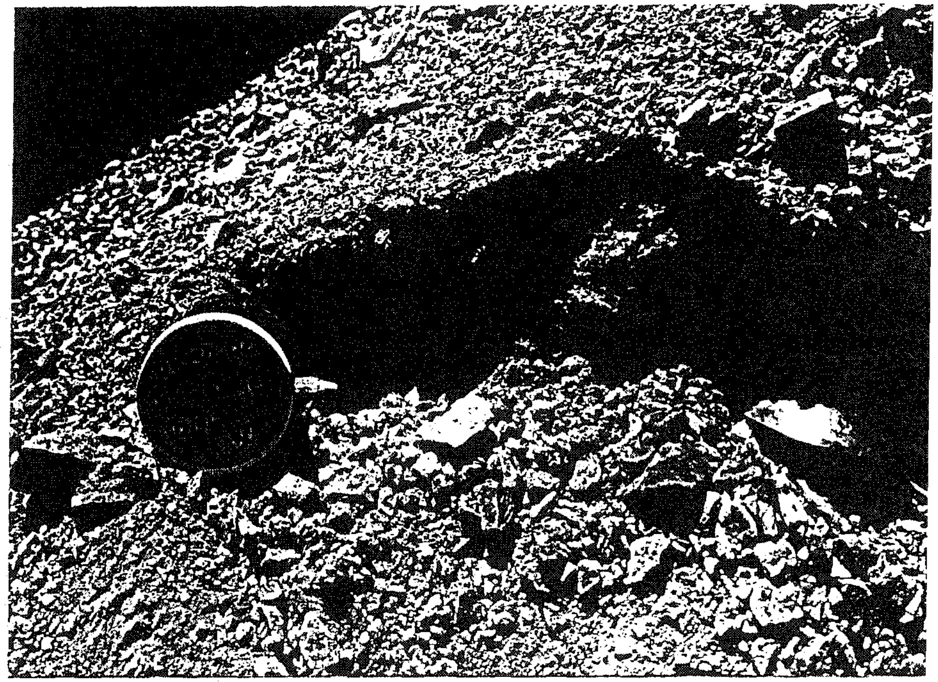
Description of Photo: PG-SO-07 Joe and John's Mine adit.

Date: August 6, 1996

Direction facing: North (35mm film)

OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION





Description of Photo: OP-SO-02 Silver Ledge Mine waste pile (left).

Date: August 7, 1996

Direction facing: Southeast (35mm film)

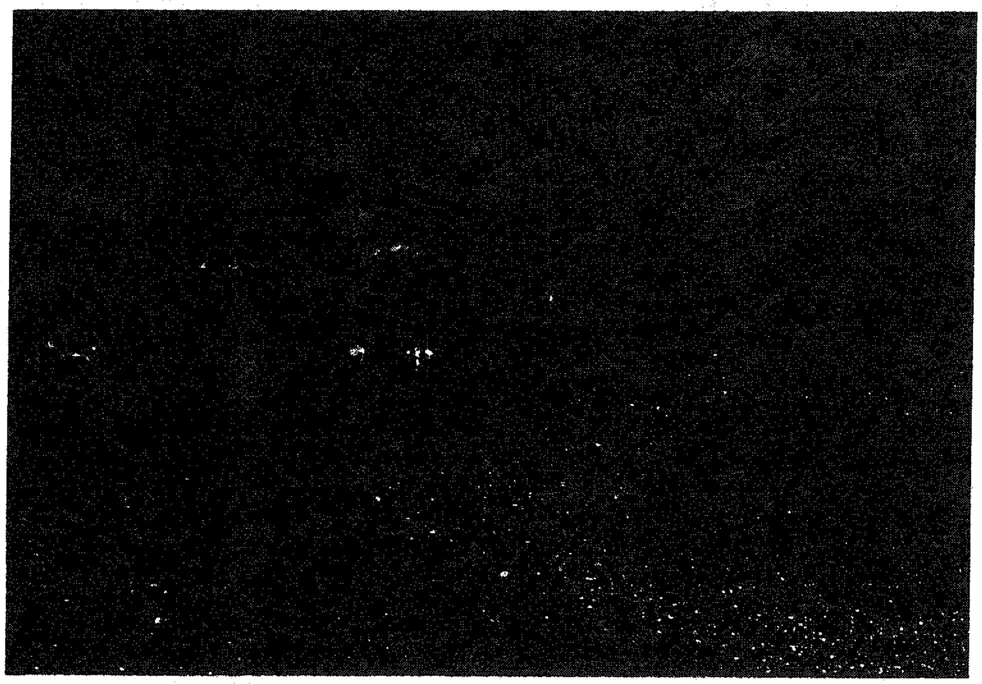
Description of Photo: OP-SO-02 Silver Ledge Mine waste pile (closeup).

Date: August 7, 1996

Direction facing: Northwest (35mm film)

1800733

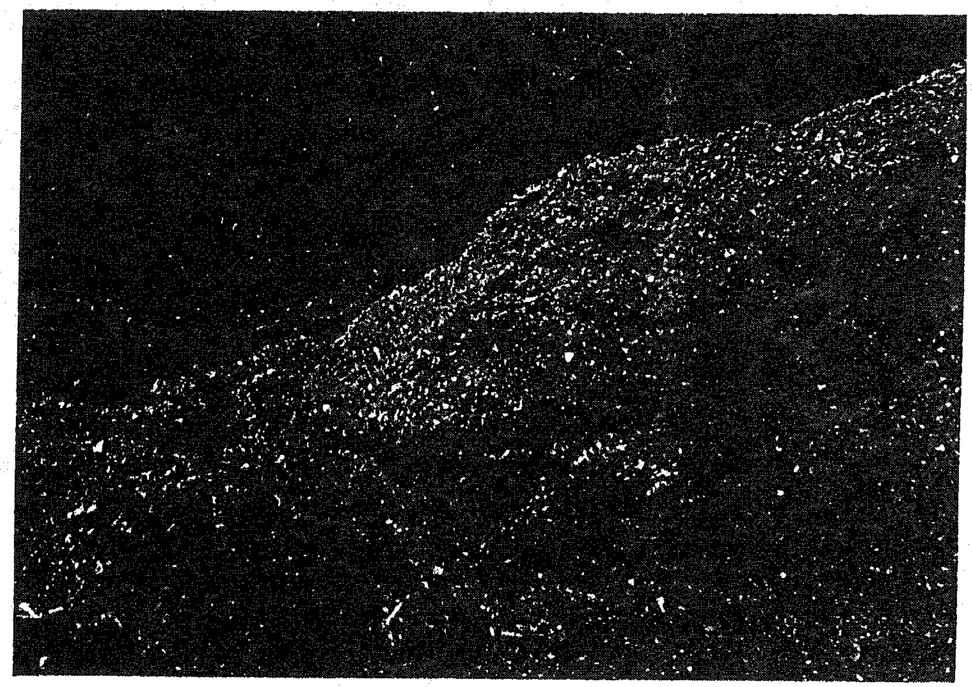
OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION



Description of Photo: OP-SO-01 Gold King Mine drainage seeping from toe of waste rock pile.

Date: August 7, 1996

Direction facing: West (35mm film)

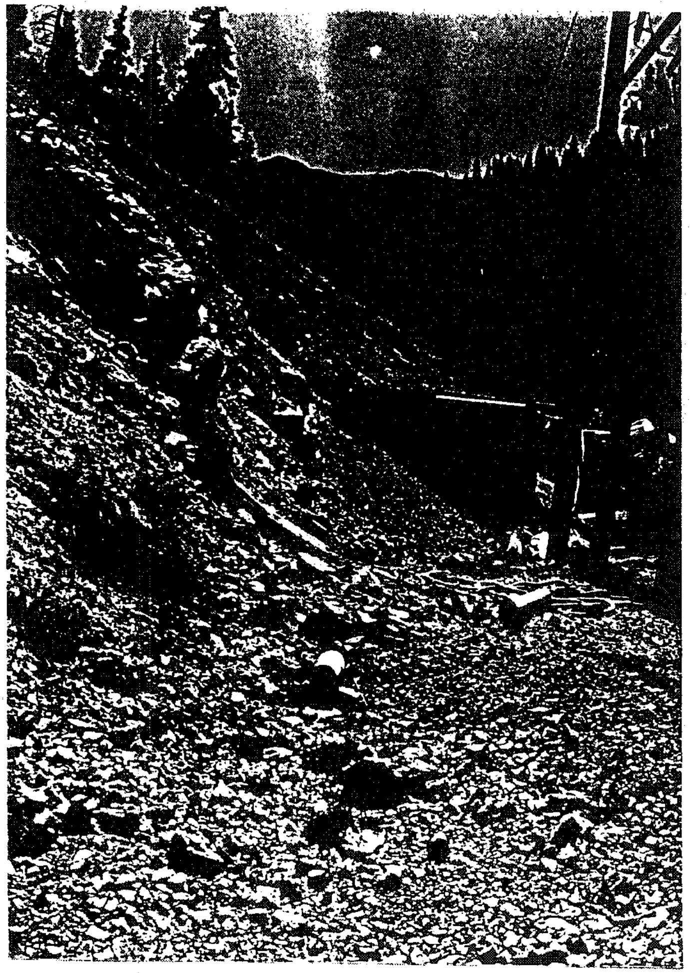


Description of Photo: OP-SO-01 Gold King Mine drainage flowing into the North Fork.

Date: August 7, 1996

Direction facing: South (35mm film)

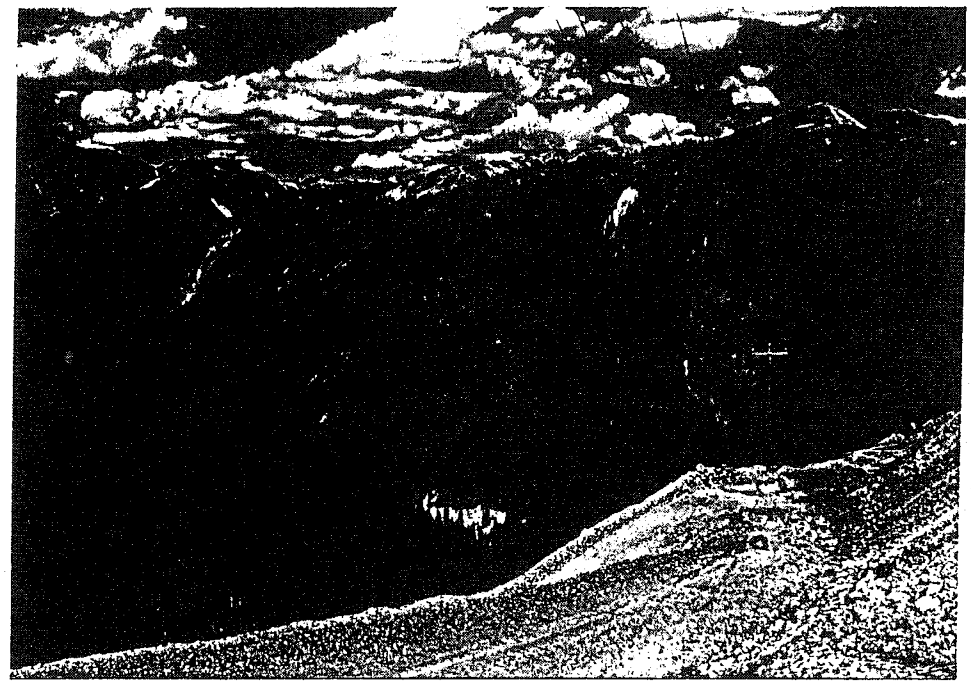
OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION



Description of Photo: OP-SO-01 Gold King Mine - draining adit.

Date: August 7, 1996

Direction facing: East (35mm film)

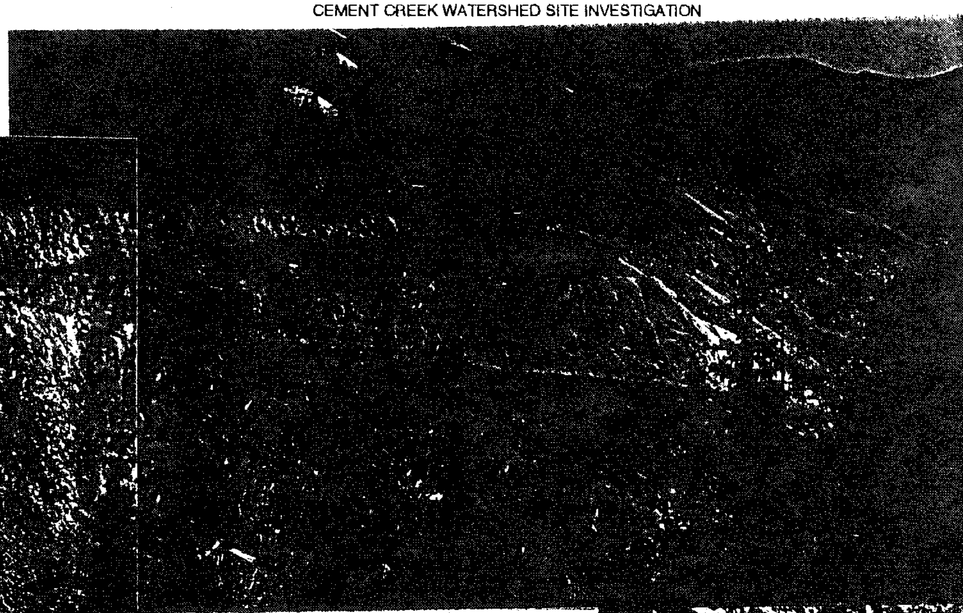


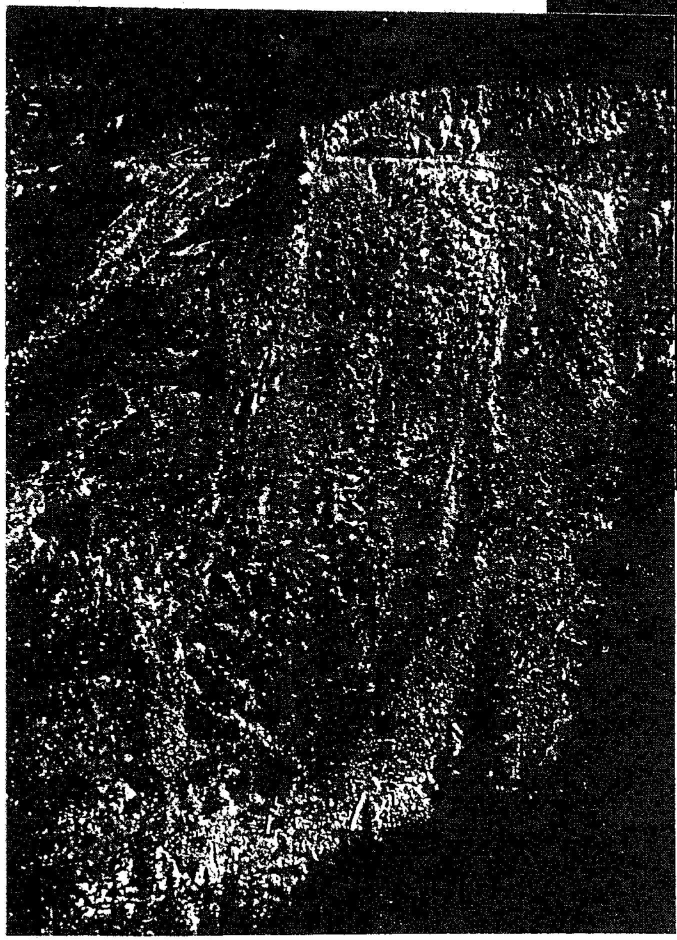
Description of Photo: OP-SO-01 Gold King Mine drainage flow path.

Date: August 7, 1996

Direction facing: West (35mm film)

OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION

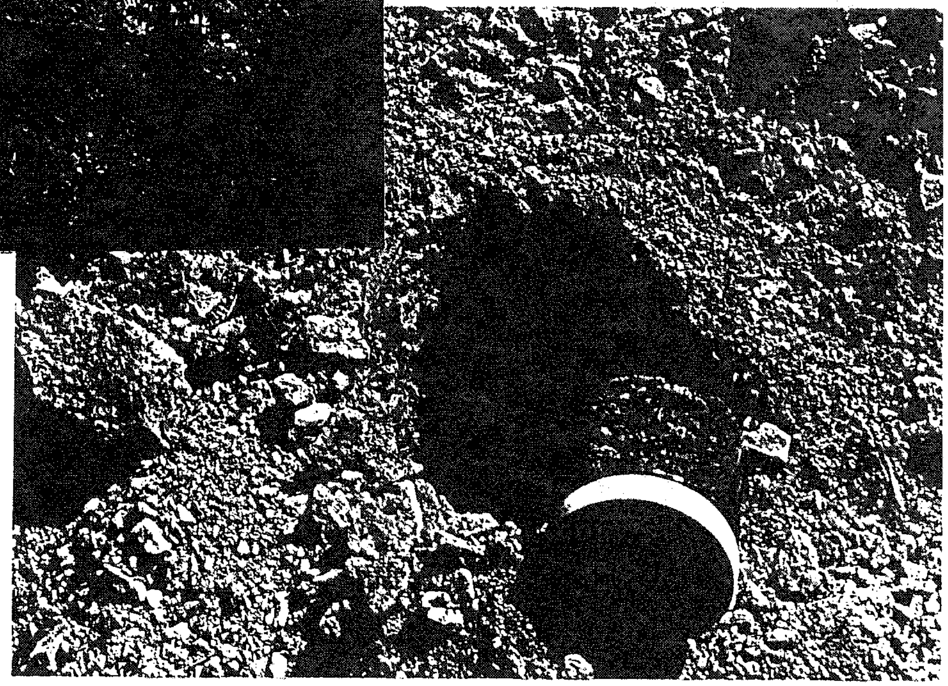




Description of Photo: OP-SO-01 Gold King Mine Waste Pile.

Date: August 7, 1996

Direction facing: North (35mm film)



Description of Photo: OP-SO-01 Gold King Mine Waste Pile (closeup).

Date: August 7, 1996

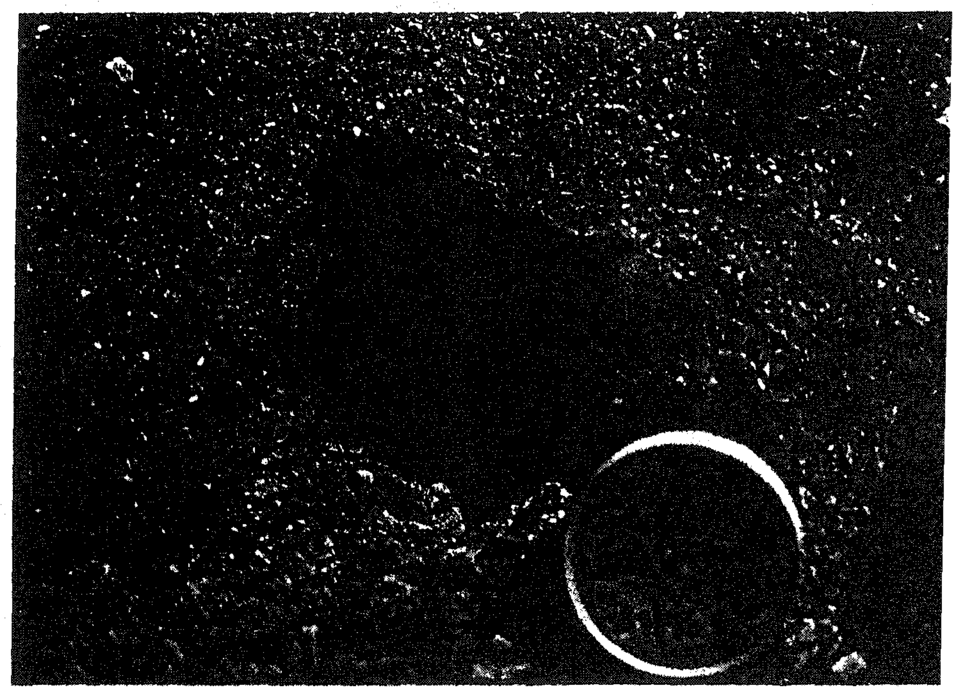
Direction facing: North (35mm film)

OFFICIAL PHOTOGRAPHS
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
CEMENT CREEK WATERSHED SITE INVESTIGATION

Description of Photo: CC-SO-10 Lead and Carbonate Mill Waste Pile.

Date: August 7, 1996

Direction facing: East (35mm film)



Description of Photo: CC-SO-10 Lead Carbonate Mill Waste Pile (closeup).

Date: August 7, 1996

Direction facing: East (35mm film)

APPENDIX B

DMG Sample Description, Location, Rationale and Analyses Requested

TABLE I: ANIMAS RIVER TARGETING PROJECT - CEMENT CREEK BASIN
PROPOSED CEMENT CREEK SAMPLE LOCATIONS

Sample Type	Sample ID No.	Location	Rationale	Non-Sampling Data
Surface Water Samples	CC-SW-1	Cement Creek upstream of the Queen Anne Mine.	To determine background surface water quality for Cement Creek.	(1) note observations of stream conditions such as flow rate, color, turbidity, and odor (2) note unusual or poor vegetative growth along surface water bodies (3) note the presence or absence of fish and wildlife in the area (4) note any observations of recreational fishing (5) note the presence of tailings or other potential sources within the surface water (6) note locations and extent of wetlands and sensitive environments (7) take photographs as necessary to supplement documentation of observations
	CC-SW-2	Cement Creek below the discharge from the Queen Anne Mine drainage and waste rock pile.	To assess potential contribution of substances from the Queen Anne Mine and waste pile.	
	CC-SW-3	Ross Basin tributary (Upper Cement Creek) upstream of the unnamed draining mine and waste pile.	To determine background surface water quality for Cement Creek.	
	CC-SW-4	Ross Basin tributary downstream of the unnamed draining mine and waste pile.	To assess potential contribution of substances from the Ross Basin unnamed draining mine and waste pile.	
	CC-SW-5	Cement Creek upstream of the Mogul and South Mogul Mine drainages and waste piles.	To determine ambient surface water quality in the Cement Creek immediately upstream of the Mogul and South Mogul Mines.	
	CC-SW-6	Cement Creek downstream of the Mogul and South Mogul Mine drainages and waste piles.	To assess potential contribution of substances from the Mogul and South Mogul Mine drainages and mine waste piles to Cement Creek at the probable point of entry.	
	CC-SW-7	Cement Creek above Corkscrew gulch, above small denuded area.	To determine surface water quality in Cement Creek prior to contribution of the small denuded area.	
	CC-SW-8	Cement Creek below the confluence of Corkscrew G. and the small denuded area, and above the Red & Bonita Mine.	To determine surface water quality in Cement Creek below the small denuded area and upstream of the Red & Bonita Mine.	
	CC-SW-9	Cement Creek below the Red & Bonita mine drainage and waste pile.	To assess potential contribution of substances from the Red & Bonita Mine drainage and waste pile.	
Surface Water Samples (continued)	CC-SW-10	North Fork above the Gold King Mine complex.	To determine background surface water quality in the North Fork.	
	CC-SW-11	North Fork below the Gold King Mine complex, above the natural ferricrete deposit.	To assess potential contribution of substances from the Gold King Mine complex to the North Fork.	

add line at Bottom.

TABLE I: ANIMAS RIVER TARGETING PROJECT - CEMENT CREEK BASIN
PROPOSED CEMENT CREEK SAMPLE LOCATIONS

Sample Type	Sample ID No.	Location	Rationale	Non-Sampling Data
	CC-SW-12	North Fork below the natural ferricrete deposit, above the confluence with Cement Creek.	To determine surface water quality in the North Fork from natural ferricrete deposits, as well as in the North Fork before its confluence with Cement Creek.	
	CC-SW-13	Cement Creek below the confluence with North Fork, above the confluence with South Fork.	To determine surface water quality in Cement Creek Miguel below its confluence with North Fork.	
	CC-SW-14	Minnehaha Creek above the Lead Carbonate Mill waste pile.	To determine background surface water quality in Minnehaha Creek.	
	CC-SW-15	Minnehaha Creek below the Lead Carbonate Mill waste pile.	To assess potential contribution of substances from the Lead Carbonate Mill waste pile to Minnehaha Creek.	
	CC-SW-16	Minnehaha Creek above its confluence with South Fork.	To determine surface water quality in Minnehaha Creek prior to its confluence with South Fork.	
	CC-SW-17	Middle Fork above the unnamed instream waste pile.	To determine background surface water quality in the Middle Fork.	
	CC-SW-18	Middle Fork below the unnamed instream waste pile.	To assess potential contribution of substances from the unnamed instream waste pile to Middle Fork at the probable point of entry.	
Surface Water Samples (continued)	CC-SW-19	Middle fork below the Black Hawk Mine drainage and waste pile.	To assess the potential contribution of substances from the Black Hawk Mine drainage and waste pile to the Middle Fork.	
	CC-SW-20	Middle fork above its confluence with South Fork.	To determine surface water quality in the Middle Fork below combined mine waste sources.	
	CC-SW-21	South Fork above the Silver Ledge Mine drainage and waste pile.	To determine background surface water quality of the South Fork.	
	CC-SW-22	South Fork below the Silver Ledge Mine drainage and waste pile.	To assess potential contribution of substances form the Silver Ledge mine drainage and waste pile to South Fork at the probable point of entry.	

TABLE I: ANIMAS RIVER TARGETING PROJECT - CEMENT CREEK BASIN
PROPOSED CEMENT CREEK SAMPLE LOCATIONS

Sample Type	Sample ID No.	Location	Rationale	Non-Sampling Data
	CC-SW-23	South Fork above its confluence with Cement Creek.	To assess potential contributions of substances form South Fork to Cement Creek.	
	CC-SW-24	Cement Creek below the confluence with South Fork.	To determine surface water quality in Cement Creek below the confluence with South Fork.	
	CC-SW-25	Cement Creek above its confluence with Prospect Gulch.	To determine surface water quality of Cement Creek above its confluence with Prospect Gulch.	
	CC-SW-26	Cement Creek below its confluence with Prospect Gulch.	To determine surface water quality of Cement Creek below its confluence with Prospect Gulch.	
	CC-SW-27	Cement Creek above its confluence with Ohio Gulch.	To determine surface water quality of Cement Creek above its confluence with Ohio Gulch.	
Surface Water Samples (continued)	CC-SW-28	Ohio Gulch above its confluence with Cement Creek.	To assess potential contribution of substances from Ohio Gulch to Cement Creek.	
	CC-SW-29	Cement Creek ~~below its confluence with Ohio Gulch,~~ above the Gold Hub Mine.	To determine surface water quality of Cement Creek below its confluence with Ohio Gulch.	
	CC-SW-30	~~Cement Creek below~~ the Gold Hub Mine, above the Anglo Saxon Mine.	To assess potential contribution of substances from the Gold Hub Mine drainage and waste pile to Cement Creek at the probable point of entry.	
	CC-SW-31	Cement Creek below the Anglo Saxon Mine drainage and waste pile.	To assess potential contribution of substances from the Anglo Saxon Mine drainage and waste pile to Cement Creek at the probable point of entry.	
	CC-SW-32	Cement Creek above its confluence with the Animas River.	To determine surface water quality of Cement Creek above its confluence with the Animas River.	
	CC-SW-33	Animas River above the confluence with Cement Creek.	To determine surface water quality of the Animas River above its confluence with Cement Creek.	
	CC-SW-34	Mineral Creek above confluence with the Animas River.	To determine ambient water quality in Mineral Creek.	

1800733

TABLE I: ANIMAS RIVER TARGETING PROJECT - CEMENT CREEK BASIN
PROPOSED CEMENT CREEK SAMPLE LOCATIONS

Sample Type	Sample ID No.	Location	Rationale	Non-Sampling Data
	CC-SW-35 A12	Animas River below the confluence of Mineral Creek.	To assess potential contribution of substances from Mineral Creek to the Animas River at a point below their confluence.	

ED_000552_00029910-00173

TABLE I: ANIMAS RIVER TARGETING PROJECT - CEMENT CREEK BASIN
PROPDSED CEMENT CREEK SAMPLE LOCATIONS

Sample Type	Sample ID No.	Location	Rationale	Non-Sampling Data
Aqueous Source Samples	CC-SO-01	Queen Anne Mine Drainage.	Source Characterization.	
	CC-SO-03	Ross Basin unnamed Mine drainage.		
	CC-SO-05	Mogul Mine drainage.		
	CC-SO-07	South Mogul Mine drainage.		
	CC-SO-08	Red & Bonita Mine drainage.		
	CC-SO-12	Black Hawk Mine drainage.		
	CC-SO-13	Silver Ledge Mine drainage.		
	CC-SO-14	Gold Hub Mine drainage.		
	CC-SO-16	Anglo Saxon Mine drainage.		
Quality Assurance/ Quality Control	CC-SW-36	Duplicate of SW-24	Quality control sample to assess accuracy and precision.	
	CC-SW-37	Duplicate of SW-31		
	CC-SW-38	Field blank for Day 1 sampling.	Quality control sample to assess potential field contamination.	
	CC-SW-39	Field Blank for Day 2 sampling.		
	CC-SW-40	Rinsate Blank for Day 1 sampling.	Quality control to assess field decontamination procedures.	
	CC-SW-41	Rinsate Blank for Day 2 sampling.		

TABLE II: ANIMAS RIVER TARGETING PROJECT - CEMENT CREEK BASIN
PROPOSED PROSPECT GULCH SAMPLE LOCATIONS

Sample Type	Sample ID No.	Location	Rationale	Non-Sampling Data
Surface Water Samples	PG-SW-1	Prospect Gulch upstream of the Galena Queen Mine waste pile.	To determine background surface water quality for Prospect Gulch.	(1) note observations of stream conditions such as flow rate, color, turbidity, and odor (2) note unusual or poor vegetative growth along surface water bodies (3) note the presence or absence of fish and wildlife in the area (4) note any observations of recreational fishing (5) note the presence of tailings or other potential sources within the surface water (6) note locations and extent of wetlands and sensitive environments (7) take photographs as necessary to supplement documentation of observations
	PG-SW-2	Prospect Gulch upstream of the Galena Queen Mine waste pile.	To determine background surface water quality for Prospect Gulch.	
	PG-SW-3	Prospect Gulch below the Galena Queen Mine.	To assess potential contribution of substances from the Galena Queen Mine waste (SO-1) at the probable point of entry.	
	PG-SW-4	Tributary to Prospect Gulch.	To determine background surface water contributions to Prospect Gulch.	
	PG-SW-5	Tributary with Acid Rock Drainage.	To assess potential contribution of substances from the tributary with ARD to Prospect Gulch.	
	PG-SW-6	Tributary with Hercules Mine wast located therein.	To assess potential contribution of substances from the Hercules Mine waste pile (SO-2) to Prospect Gulch.	
	PG-SW-7	Tributary with Acid rock Drainage.	To assess potential contribution of substances from the tributary with ARD to Prospect Gulch.	
	PG-SW-8	Prospect Gulch below tributaries with mine waste and ARD.	To assess potential contribution of substances from upper basin mine workings.	
	PG-SW-9	Prospect Gulch below "mineralized canyon" and above the Henrietta Mine.	To assess potential contribution of substances from the Mineralized canyon and to determine ambient surface water quality in Prospect Gulch above the Henrietta Mine (SO-3).	

1800733

TABLE II: ANIMAS RIVER TARGETING PROJECT - CEMENT CREEK BASIN
PROPOSED PROSPECT GULCH SAMPLE LOCATIONS

Sample Type	Sample ID No.	Location	Rationale	Non-Sampling Data
Surface Water Samples (continued)	PG-SW-10	Mineralized Tributary above the Henrietta (level 7) Mine complex.	To assess background contribution of a naturally mineralized canyon to Prospect Gulch.	
	PG-SW-11	Prospect Gulch above the Henrietta Mine Complex.	To determine surface water quality in Prospect Gulch upstream of the Henrietta Mine drainage (SO-3) and waste pile (SO-4).	
	PG-SW-12	Perennial Springs upstream of the Henrietta Mine waste pile.	To assess potential contribution of substances from naturally occurring springs to Prospect Gulch.	
	PG-SW-13	Springs on top of the Henrietta Mine waste pile.	To determine quality of spring water prior to its infiltrating the Henrietta Mine Waste pile (SO-5).	
	PG-SW-14	Springs after percolating through the Henrietta Mine waste Pile.	To assess potential contribution of substances from the Henrietta Mine waste pile to springs flowing into Prospect Gulch.	
	PG-SW-15	Prospect Gulch below the Henrietta Mine complex, above the probable point of entry of the Henrietta Mine waste pile springs.	To determine surface water quality in Prospect Gulch downstream of the Henrietta Mine complex.	
	PG-SW-16	Prospect Gulch below the Henrietta Mine waste pile springs.	To determine surface water quality in Prospect Gulch below the probable point of entry of the Henrietta Mine waste pile springs.	
Surface Water Samples (continued)	PG-SW-17	Tributaries from the Upper Joe and Johns Mine.	To assess potential contribution of substances from the Upper Joe and Johns Mine to Prospect Gulch at the probable point of entry.	

ED_000552_00029910-00176

TABLE II: ANIMAS RIVER TARGETING PROJECT - CEMENT CREEK BASIN
PROPOSED PROSPECT GULCH SAMPLE LOCATIONS

Sample Type	Sample ID No.	Location	Rationale	Non-Sampling Data
	PG-SW-18	Prospect Gulch below Joe and John's mine.	To assess the potential contribution of substances from Joe and John's Mine drainage and waste pile to Prospect Gulch.	
	PG-SW-19	Prospect Gulch above confluence with Cement Creek.	To determine surface water quality in Prospect Gulch below combined mine waste sources before its confluence with Cement Creek.	
Aqueous Source Characterization Samples	PG-SO-03	Henrietta (7) Mine drainage.	Aqueous Source Characterization.	
	PG-SO-06	Joe and John's Mine drainage.		
Quality Assurance/ Quality Control Samples	PG-SW-20	Duplicate of SW-19	Quality control sample to assess accuracy and precision.	
	PG-SW-21	Field blank for Day 1 sampling.	Quality control sample to assess potential field contamination.	
	PG-SW-22	Field Blank for Day 2 sampling.		
	PG-SW-23	Rinsate Blank for Day 1 sampling.	Quality control to assess field decontamination procedures.	
	PG-SW-24	Rinsate Blank for Day 2 sampling.		

TABLE III: SAMPLE PLAN CHECKLIST
ANIMAS RIVER TARGETING PROJECT - CEMENT CREEK BASIN
Upper Cement Creek Basin and the Mainstem of Cement Creek

Sample Location	Sample Type	Field Parameter					Laboratory Parameters				
		Temp.	pH	Cond	Flow	Fe2+/Fe3+	Total Metals	Dissolved Metals	Dup	Spike	Blank
CC-SW-1	water	X	X	X	X	X	X	X			
CC-SW-2	water	X	X	X	X	X	X	X			
CC-SW-3	water	X	X	X	X	X	X	X			
CC-SW-4	water	X	X	X	X	X	X	X			
CC-SW-5	water	X	X	X	X	X	X	X			
CC-SW-6	water	X	X	X	X	X	X	X		3x volume	
CC-SW-7	water	X	X	X	X	X	X	X			
CC-SW-8	water	X	X	X	X	X	X	X			
CC-SW-9	water	X	X	X	X	X	X	X			
CC-SW-10	water	X	X	X	X	X	X	X			
CC-SW-11	water	X	X	X	X	X	X	X			
CC-SW-12	water	X	X	X	X	X	X	X			
CC-SW-13	water	X	X	X	X	X	X	X			
CC-SW-14	water	X	X	X	X	X	X	X			
CC-SW-15	water	X	X	X	X	X	X	X			
CC-SW-16	water	X	X	X	X	X	X	X			
CC-SW-17	water	X	X	X	X	X	X	X			
CC-SW-18	water	X	X	X	X	X	X	X			
CC-SW-19	water	X	X	X	X	X	X	X			
CC-SW-20	water	X	X	X	X	X	X	X			
CC-SW-21	water	X	X	X	X	X	X	X			
CC-SW-22	water	X	X	X	X	X	X	X			
CC-SW-23	water	X	X	X	X	X	X	X			
CC-SW-24	water	X	X	X	X	X	X	X			
CC-SW-25	water	X	X	X	X	X	X	X			
CC-SW-26	water	X	X	X	X	X	X	X			
CC-SW-27	water	X	X	X	X	X	X	X			
CC-SW-28	water	X	X	X	X	X	X	X			
CC-SW-29	water	X	X	X	X	X	X	X			
CC-SW-30	water	X	X	X	X	X	X	X			
CC-SW-31	water	X	X	X	X	X	X	X			

TABLE III: SAMPLE PLAN CHECKLIST
ANIMAS RIVER TARGETING PROJECT - CEMENT CREEK BASIN
Upper Cement Creek Basin and the Mainstem of Cement Creek
Page of 2

Sample Location	Sample Type	Field Parameter					Laboratory Parameters				
		Temp.	pH	Cond	Flow	Fe2+/Fe3+	Total Metals	Dissolved Metals	Dup	Spike	Blank
CC-SW-32	water	X	X	X	X	X	X	X			
CC-SW-33	water	X	X	X	X	X	X	X			
CC-SW-34	water	X	X	X	X	X	X	X			
CC-SW-35	water	X	X	X	X	X	X	X			
CC-SO-01	water	X	X	X	X	X	X	X			
CC-SO-03	water	X	X	X	X	X	X	X			
CC-SO-05	water	X	X	X	X	X	X	X			
CC-SO-07	water	X	X	X	X	X	X	X			
CC-SO-08	water	X	X	X	X	X	X	X			
CC-SO-12	water	X	X	X	X	X	X	X			
CC-SO-13	water	X	X	X	X	X	X	X			
CC-SO-14	water	X	X	X	X	X	X	X			
CC-SO-15	water	X	X	X	X	X	X	X			
CC-SW-36	QA/QC water						X	X	SW-24		
CC-SW-37	QA/QC water						X	X	SW-31		
CC-SW-38	QA/QC water						X	X			X
CC-SW-39	QA/QC water						X	X			X
CC-SW-40	QA/QC water						X	X			X
CC-SW-41	QA/QC water						X	X			X

TABLE IV: SAMPLE PLAN CHECKLIST
ANIMAS RIVER TARGETING PROJECT - CEMENT CREEK BASIN
Prospect Gulch Basin

Sample Location	Sample Type	Field Parameter					Laboratory Parameters				
		Temp.	pH	Cond	Flow	Fe2+/Fe3+	Total Metals	Dissolved Metals	Dup.	Spike	Blank
PG-SW-1	water	X	X	X	X	X	X	X			
PG-SW-2	water	X	X	X	X	X	X	X			
PG-SW-3	water	X	X	X	X	X	X	X			
PG-SW-4	water	X	X	X	X	X	X	X			
PG-SW-5	water	X	X	X	X	X	X	X			
PG-SW-6	water	X	X	X	X	X	X	X		3x volume	
PG-SW-7	water	X	X	X	X	X	X	X			
PG-SW-8	water	X	X	X	X	X	X	X			
PG-SW-9	water	X	X	X	X	X	X	X			
PG-SW-10	water	X	X	X	X	X	X	X			
PG-SW-11	water	X	X	X	X	X	X	X			
PG-SW-12	water	X	X	X	X	X	X	X			
PG-SW-13	water	X	X	X	X	X	X	X			
PG-SW-14	water	X	X	X	X	X	X	X			
PG-SW-15	water	X	X	X	X	X	X	X			
PG-SW-16	water	X	X	X	X	X	X	X			
PG-SW-17	water	X	X	X	X	X	X	X			
PG-SW-18	water	X	X	X	X	X	X	X			
PG-SW-19	water	X	X	X	X	X	X	X			
PG-SO-03	water	X	X	X	X	X	X	X			
PG-SO-06	water	X	X	X	X	X	X	X			
PG-SW-20	QA/QC water						X	X	SW-19		
PG-SW-21	QA/QC water						X	X			X
PG-SW-22	QA/QC water						X	X			X
PG-SW-23	QA/QC water						X	X			X
PG-SW-24	QA/QC water						X	X			X